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ABSTRACT

The first volume in a series of publications describing the basic documentation practices involved in the initial setting up and subsequent operation of an information-library organization to provide defense-aerospace scientific and technical information services, this manual consists of three sections. "Acquisition and Sources," by Philip Eckert, offers suggestions and ideas for acquiring documents or their surrogates and dealing with problems in selection and duplicate checking. A semiautomated duplicate search technique and alerting methods for prospective documentation are described. Appendices include two category systems, selected definitions and acronyms, and a selected address list for document procurement. "Descriptive Cataloging," by Barbara Gladd and others, defines the functions and purposes of descriptive cataloging in processing technical reports and compares the merits of manual vs. automated systems. Descriptive data elements and guidelines for their use in implementing a system already automated or to be automated in the future are presented, and personnel and staffing considerations are discussed. "Abstracting and Subject Analysis," by Toni Carbo Bearman, summarizes and provides an overview of the practical aspects of abstracting, indexing, thesaurus development, and the use of computers in abstracting and indexing. References to relevant standards are included. (Author/RAA)

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Volume I

NORTH ATLANTIC TREATY ORGANIZATION

ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT

(ORGANISATION DU TRAITE DE L'ATLANTIQUE NORD)

AGARDograph No.235

MANUAL OF DOCUMENTATION PRACTICES APPLICABLE TO DEFENCE-AEROSPACE SCIENTIFIC AND TECHNICAL INFORMATION

VOLUME I
containing

Section

1 – ACQUISITION AND SOURCES
2 – DESCRIPTIVE CATALOGUING
3 – ABSTRACTING AND SUBJECT ANALYSIS

(The complete Publication Layout appears on page iv.)

IR009727

This AGARDograph has been prepared at the request of the Technical Information Panel of AGARD.

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GENERAL FOREWORD

The purpose of this Manual is to describe in a series of separately-published Volumes the basic documentation practices which are involved in the initial setting up, and subsequent operation of an Information-Library Organisation to provide defence-aerospace scientific and technical information services.

- The manual is primarily intended for the main defence-aerospace information centres in the smaller nations, and the specialised defence establishments and defence contractors in the larger NATO countries.

- For those information centres which already have a well-developed system, the manual may prove helpful in the work of analyzing and evaluating existing system performance, or in revising an ineffective system. An important subsidiary objective is therefore to encourage the greater use of modern techniques of information processing.

- The manual endeavours to meet the needs of a wide spectrum of readers – the senior man concerned with setting up a new system, as well as junior staff who may be using the manual as a training aid.

- The various Sections aim to focus on the problems and techniques associated with processing unpublished reports and related information, rather than conventional book-journal libraries. Emphasis is on practical solutions and, where appropriate, useful operating suggestions.

The manual has been planned by the AGARD Technical Information Panel and will consist of four Volumes comprising twelve Sections in all, each prepared by a well-known expert in the field. The Publication Layout is given on the following page and publication of the complete set will be spread over three to four years.

S.C.SCHULER
General Editor
(Former Chairman, AGARD
Technical Information Panel)

MANUAL OF DOCUMENTATION PRACTICES APPLICABLE TO
DEFENCE-AEROSPACE SCIENTIFIC AND TECHNICAL INFORMATION

PUBLICATION LAYOUT

Section

VOLUME I

1 ACQUISITION & SOURCES, by P.F.Eckert
Types of material, screening, evaluation, sources in Governments and other countries, information on current research

2 DESCRIPTIVE CATALOGUING, by B.P.Gladd, O.G.Luchaka and J.C.Wade
Functions, standardisation, corporate authors and other compatibility factors, document process sheets, manual and computer translations

3 ABSTRACTING & SUBJECT ANALYSIS, by T.C.Bearman
Abstracting standards, descriptor allocation, thesaurus, computer-aided indexing

VOLUME II*

4 DATA RECORDING & STORAGE
Data preparation rules, handling chemical compounds and scientific symbols, etc., card systems, tape typewriters, introduction to computerised operations

5 MECHANIZATION SYSTEMS & OPERATIONS
Simple mechanisation, in-house computer, minicomputers, bureau working

6 ANNOUNCEMENT SERVICES & PUBLICATIONS
Selective dissemination of information, bulletin production, newsletters and digests, bibliographies

VOLUME III*

7 SEARCH & INFORMATION RETRIEVAL
Manual systems, on-line systems, inverted files, batch working

8 DISSEMINATION
Initial distribution, specific requests, guidelines on sensitive aspects, conditions of release

9 MICROFORM SYSTEMS & REPROGRAPHY
Microfiche preparation and copying, offset printing

VOLUME IV*

10 SECURITY STORAGE, REGRADING
Security grading procedures, storage methods, weeding

11 ORGANISATION & MANAGEMENT
Aims and objectives, staffing, promotional activities, identifying users

12 NETWORKS & EXTERNAL SOURCES OF INFORMATION
National and international

* To be issued later. The contents listed here are those presently proposed: they may be amended, however, as their preparation progresses.

Section 1

ACQUISITION AND SOURCES

by
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NASA Scientific and Technical Information Facility
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ABSTRACT

Suggestions and ideas for acquiring documents or their surrogates for a planned or fledgling information system are offered. The problems of selectivity of documents or their surrogates, both in superabundant quantities, and duplicate checking are highlighted. Acquisitioning flow, a semiautomated duplicate search technique, and alerting methods for prospective documentation are described. Appendices include two category systems, selected definitions and acronyms, and a selected address list for document procurement.

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1. INTRODUCTION

1.1 The purpose of this Section of the Manual is to provide advice concerning document procurement and acquisition for a planned or newly-operating technical information center. The perfect acquisitions systems for a technical document processing organization does not exist. Furthermore, according to Weisbrod, there exists no standard operational definition for an acquisitions system[1]. The literature is saturated with automated and semiautomated acquisition methods for books, serials, and periodicals but is virtually devoid of material for documents, such as technical reports, journal articles, or theses. With this fact in mind, the author will attempt to provide ideas and hints for the development of a workable acquisitioning operation – mostly from 15 years' experience in a large, operational information facility.

1.2 The following assumptions have been made. The establishment of a document system has been sanctioned by the host government or the host defence/aerospace contractor; there will be adequate funding to support the operation; document data will be captured and eventually be capable of manipulation to provide literature searches from text (abstract and title), vocabulary subject indexing, personal author, corporate source (originating agency), contract number, and report number; and informal computer-produced listings (to assist the duplicate checking operation) can be generated. Further assumptions include that the file buildup will be deliberately slow-to-moderate during the first three years of operation and that, from the fifth year and later, the maximum annual input goals will have been met.

1.3 One final assumption is that the file could be split into three or four accession series as follows:

File 1 – Unclassified/unlimited documents two years old or less.
File 2 – Unclassified/unlimited documents over two years in age.
File 3 – Unclassified limited distribution and security classified documents.
File 4 – Open literature articles (published literature) one year old or less.

Informal listings or formal announcement bulletins or journals could be generated from any of these files – singly or in combination.

2. DOCUMENTS MATERIAL, SCOPE, AND DEFINITIONS

2.1 The material for the system is defined as follows:

- Documents, in hardcopy or microfiche – complete in either form.
- Document surrogates – the bibliographic citation and abstract of a document in hardcopy or in a machine-readable medium.

2.2 Document surrogates in lieu of actual hardcopy or microfiche are suitable for entry into a data base provided the citation indicates the source availability of the document (where the user ultimately can find or purchase the document). Typical availability entries are:

- Avail – NTIS
- Avail – ESA
- Avail – GPO
- Avail – ZLDI
- Avail – Issuing Activity

2.3 Report literature is commonly called the unpublished literature. To distinguish between "report" and "nonreport" literature the following table is offered:

Reports	*Nonreports*
Topical reports	Proposals
Progress reports	Loose-leaf manuals
Monthly	Handbooks
Quarterly	Specifications and standards
Semiannual	Journals
Annual	Abstract journals
(Interim)	Preprints of conference papers
Final reports	Preprints of journal articles
Summary reports	Reprints
Translations of reports (cover-to-cover)	Books and book chapters
Patents	
Patent applications	
Dissertations	
Dissertation abstracts	

2.4 The published or so-called open literature for File 4 mentioned above consists of journal and periodical articles, books, pamphlets, monographs, scientific meeting papers, translations of journals and journal articles, reprints, preprints, and collected works containing documents written by different authors and relating to a common subject. There is an overlapping or gray area between these two types of literature, and therefore some of the subtypes such as monographs or conference proceedings may be assigned to either the report or open literature groupings.

2.5 All documents for information processing are further classified as "singles" or "analytics". A single document, often called a topical document, is an entity unto itself. It stands alone. An analytic primary is one that contains two or more independent (topical) reports or papers. Those reports or documents within an analytic (or analytic primary) are called analytic subsidiaries. The primary is often called the parent or "mother" and the subsidiaries, the "daughters". See definition of "analytical entry" in Appendix 2.

2.6 The subject areas for the scope of this system are far-reaching. They include the jointly used category system of NASA in the USA, ESA in Europe, and the ZLDI, in its *Konferenzberichte Luftfahrt Raumfahrt Weltraumforschung*, produced in the FRG. The category system includes 74 categories in 10 major divisions and one general division/category. The COSATI categories, based on 22 major fields, may also be used in the determination of document relevance for the system. The COSATI category system was designed to cover several major areas. Of the 22 major fields, Field 2 – Agriculture, is perhaps the least relevant for a defence/aerospace system. This is not to state, however, that all documents in this field should be excluded. Documents on the subject of crop and timber inventories (accomplished in part by Earth Resources satellites) possess a high degree of relevancy and should be included. The two category systems are contained in Appendix 1.

2.7 The term "acquisition" is defined as synonymous to "accession" in the *Glossary of Documentation Terms* AGARD-AG-182 Part 1 (Ref.2).

Under "accession", we find:

(1) "A document or piece of information which has been added to a collection."

(2) "The process of procuring a document for a collection."

At this point we must note that the terms "accession" and "acquisition" are both nouns and that the term "accession" is also a verb. "Acquisition" is solely a noun and is defined usually as the process of acquiring. It should also be noted that some documents may be acquired for a system but not accessioned for some reason or another. Acquired documents in such cases become rejects and are destroyed or disposed of in accordance with local standing instructions.

3. TWO MAJOR PROBLEMS – SELECTIVITY AND DUPLICATES

3.1 With modest ceilings for total document input for the first two or three years, the biggest problem for the information scientisit or evaluator will be that of selectivity. With documents and their surrogates in superabundant quantities, the main problem will be to select the proper mix for the system. As the flood gates open with eased criteria for selection, the easier the task for the acquisitioner and the document evaluator. With rigid input limitations, selection criteria should include age of report, originating agency, subject of the document, etc. The subject category should be determined by the evaluator or another employee prior to decision for acceptance.

3.2 The other major problem will be the checking for duplicates. This imperfect process for almost all large systems is known as duplicate searching, duplicate checking, or "dupe checking". Duplicates have penetrated most systems because of human error. Fortunately, no grave effects have resulted from accessioned duplicates. Known and conspicuous duplicates should be removed from the file. Some administrators have dispensed with complete eradication of duplicates, using the rationale that it is more cost-effective to let a few of them reside on the data base than to find and remove them.

3.2.1 A "bibliographic duplicate" document is an exact replica in content and descriptive data of another. One copy may bear a second-party report number on it and the other, not.

3.2.2 A "pseudo-duplicate" is found most in the open (periodical) literature – same subject, same or slightly different date, same author, but subject content modified, by shortening, lengthening, rearranging, and sometimes with a slightly modified title. No real harm is done to a system with this type of duplicate. On the contrary, a secondary source availability may be offered, thus making the document more easily available.

3.2.3 A "translation duplicate" is simply a translation of an original effort. It is a translation of a report into another language from the original language and is usually accomplished some time after the original publication date. Again, no real harm is done to a system with this type of duplicate. Some requesters or users often prefer the document in its original language.

4. DOCUMENT SOURCES AND INPUT LEVELS

4.1 Host country sources should be tapped for initial and automatic distribution as a first priority. The receipt of unclassified/unlimited documents present few problems for a fledgling system provided the document originators are familiar with the system's mission. The acquiring of security-classified documents and proprietary or commercial-in-confidence documents requires intensive negotiations between the system operators and the host government or host industries.

4.2 The handling of security-classified and/or limited distribution documents requires rigid computer security safeguards as well as physical safeguards. Operators of new systems should not set high goals for these types of documents. Industrial organizations are reluctant to let proprietary information out of their confines because accidental disclosure of a new process or technology could result in unauthorized technology transfer and a potentially large financial loss for the company that generated the proprietary document.

4.3 As a secondary priority, documents or their surrogates can be selected from the NASA *STAR* (Scientific and Technical Aerospace Reports), the NTIS (National Technical Information Service), *GRAI* (Government Reports Announcements & Indexes), *Monthly Catalog of United States Government Publications, R & D Abstracts (UK)*, and from other in-scope journals and various accession lists. See Appendix 3 for a selected address list of document handling organizations. Also, as a starter, *NTIS Information Services General Catalog No.5* of October 1977 (Ref.3) should be obtained. It contains a wealth of information concerning document procurement, NTIS data file on tape, *Selected Research in Microfiche*, and other services from NTIS.

4.4 Reasonable input levels for a fledgling system could be:

400 accessions/month for the first year
600 accessions/month for the second year
700 accessions/month for the third year
1000 accessions/month for the fourth year
1500 accessions/month for the fifth year and later

A reasonable ratio for unclassified/unlimited accessions to limited distribution/security-classified documents is 15 to 1. This ratio permits a high rate of dissemination to a wide spectrum of users. Conversely, if only 5 to 10 percent of a file were unclassified/unlimited, there would be very little dissemination of the file's technology.

4.5 A three-month buildup of documents should be accumulated before the system is implemented to insure a steady workflow. An initial shortage of documents followed by a flood of documents will disrupt the entire production line. The monthly goals can be increased as the production line works as a team and the acquisitioners can insure a steady, unfaltering supply.

5. DOCUMENT PROCUREMENT

The overall document acquisition and processing scheme is shown in Figure 1.

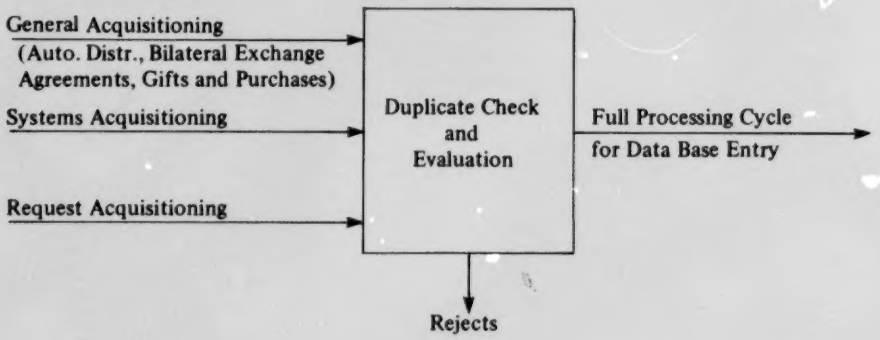


Fig.1 Document acquisition and processing

5.1 General Acquisitioning

Documents have been generally acquired by one or more of the following methods: (a) routine distribution by host countries and foreign sources; (b) bilateral agreements with foreign sources; (c) gifts (relevant published literature, books,

conference proceedings, etc.); and (d) direct purchases[4,5,6]. The receipt of solicited or unsolicited, relevant documents should be followed up with the utmost zeal – to be placed on automatic distribution for all relevant documents.

5.2 Systems Acquisitioning

The systems acquisitioning activity will obtain and review continuously relevant reference lists, accession lists, abstract journals, bibliographies, etc., for selecting potential candidates for the system. Current brochures from the John Crerar Library (Chicago) and the European Translations Centre (Delft) should be obtained to provide adequate scanning coverage for translations. Publicly announced contracts should be followed with a determined effort to be placed on automatic distribution for single or periodic progress reports. (See Paragraph 10 for hints on alerting methods for new documentation.) If automatic distribution worked perfectly at all times, there would be little need for an overt acquisition effort. Such is not the case, and continual monitoring is required to insure timely receipt of the report literature. A sample request form for automatic distribution is contained in Appendix 4.

5.3 Request Acquisitioning

The request acquisitioning activity procures documents not already in the system that are requested by eligible recipients. This type of acquisitioning produces good quality documents for the system. As for quantity, it ranks far behind the results of systems acquisitioning; the yield from this method is between 1 to 100 and 1 to 1000 when compared to the system acquisitioning method. A sample request form for this method is contained in Appendix 5.

6. DUPLICATE SEARCH

6.1 As previously mentioned, the duplicate search of a candidate document for a system is not perfect, even when assisted by the computer. In the early stages of a new system, a manual effort is suggested. For the technical report literature, a duplicate search file should be set up alphabetically by the first significant word in the title under the Corporate Source. This file can be used as an address file and for duplicate searching of documents previously acquired. There are 10 or 11 words in the English language that account for about 25 percent of any text[7], and they should be treated as "insignificant", "function", or "stop"words at the beginning of a title. A selected "stop word" list for documentation is:

A	AT	THE
AN	FOR	TO
AS	OF	WITH
BY	ON	

A document entitled "The Use of FEP TEFLON in Solar Cell Technology" should be filed by "Use" under its Corporate Source.

6.2 If an open literature or file is included in the data base, a duplicate search file should be by author, using the same filing scheme for the title.

7. TECHNICAL EVALUATION

7.1 Technical document evaluation or screening of acquired materials is done by the Technical Document Evaluator. The Technical Document Evaluator examines more closely the items that have passed an initial evaluation and accepts them or rejects them according to established policy. After acceptance the Technical Document Evaluator should make appropriate entries on the document input form for:

- Legal Reproducibility
- Microfiche Requirement
- Availability
- Single or Analytic Treatment
- File Assignment
- Special Handling
- Other, as applicable

7.2 The Technical Document Evaluator must be able to screen documents (or their surrogates) in the form in which they are received. The knack of viewing selected frames of a microfiche on a microfiche reader/printer will be developed quickly after the evaluator has gained moderate experience on the reader/printer and extensive experience from hardcopy evaluation.

7.3 Reevaluation of a document by the Technical Document Evaluator will be required for errata, addenda, supersession, security reclassification, security declassification, or major change in availability.

7.3.1 An insignificant change (which does not affect the technical integrity or the security classification) requires no action other than to file the change with the accessioned document (e.g., in the case file).

7.3.2 A comprehensive change (one that affects the technical integrity of the report) may require the withdrawal of the report from the data base and reannouncement as a new report.

8. FILES FOR DOCUMENT PROCUREMENT (MINIMUM)

8.1 Acquisitions Duplicate Search File

This file consists of the report and open literature subfiles as described in Paragraph 6.1 on page 6.

8.2 Acquisitions Suspense File

This is a holding file for document requests arranged in request-number order, pending receipt of the requested document.

8.3 Acquisitions Completed File

This file contains all correspondence relative to a completed acquisitions effort for a document, arranged in request-number sequence.

8.4 D-Letter File

This file, arranged in D-Number sequence, consists of copies of form letters to various document sources requesting automatic distribution of reports relevant to the system (defence/aerospace-related material) as described in Paragraph 5.2 on page 6.

9. SEMIAUTOMATED DUPLICATE SEARCH TECHNIQUE

9.1 This technique should not be attempted until a fledgling system has completed a successful shakedown period of three or four years or the system has a document population in excess of 30,000. Text search of a title consisting of a phrase "FEP Teflon" would locate all accessioned documents with that phrase in their titles. Text searching of a title may prove to be best for semiautomated duplicate searching because many documents lack personal authors, report numbers, or contract numbers. All documents have titles, and a proliferation of text searching capability for medium- or large-scale systems over the next few years is confidently predicted.

9.2 The use of a COM (Computer Output Microfilm) permuted title file for a document data base of 30,000 or more accessions could also be a cost-effective measure for the duplicate check operation. A permuted or KWIC (Keyword in Context) file of the titles employing the stop words in Paragraph 6.1 on page 6, would require about 240,000 line entries on a COM file for a 30,000-document data base. One RECORDAK (Eastman Kodak Co.) or 3M (Minnesota Mining and Mfg. Co.) 16-mm microfilm cartridge will accommodate 5000 frames (on thin film) at 61 line entries per frame, a total of 305,000 line entries. With such a file, all card files used for duplicate searching may be discarded except those used for new acquisitions.

The use of a COM file is independent of the operation of an online retrievel system and thus may be used when the central computer or the online retrieval system is being utilized for other operations or is shut down. The use of a single microfilm cartridge that replaces 30,000 to 50,000 cards will have an exhilarating effect on the duplicate search personnel resulting in an increase of the overall acquisitioning efficiency.

10. ALERTING METHODS FOR PROSPECTIVE R & D DOCUMENTS

10.1 There are several traditional methods by which the acquisitioners may be alerted to future documents. Daily scanning of the *Commerce Business Daily* (a daily list of US Government procurement invitations, contract awards, subcontracting leads, sales of surplus property, and foreign business opportunities) will provide leads and hints on future projects. Scanning of periodicals such as *Aviation Week*, *Information Hotline*, and similar foreign or host country periodicals will provide additional leads. Meeting calendars that include schedules for symposia, conferences, and congresses should not be overlooked.

10.2 Several new methods that will alert acquisitioners to future documentation have been developed; with the possible exception of the first one described below, they are not universally known.

10.2.1 Smithsonian Scientific Information Exchange (SSIE)

The SSIE current research information file contains summaries of research projects in process or initiated and completed during the two most recent years. SSIE search output consists of Notices of Research Projects (NRP's). The NRP's are collected when the work is started and retained on the file during the life of the project. All fields of basic and applied research in the life, physical, social, and engineering sciences are covered.

The basic record of the single-page NRP contains supporting and performing organization names and addresses; grant, contract, or project control number; investigator names; project title; period covered for the work; and, in most cases, a 200-word technical summary.

The file serves a multifold purpose — to avoid duplication of research effort, to identify new sources of research funding, and to provide new research documentation.

On September 1, 1977, the SSIE data base was made available to the Lockheed DIALOG Online Information Retrieval Service.

10.2.2 NASA Research and Technology Objectives and Plans Summary (RTOP)

The NASA RTOP Summary is published annually and is available from NTIS[8]. It is a compilation of NASA research projects and is designed to facilitate communication and coordination among technical personnel in government, industry, and universities. A typical summary, accessible in the RTOP publication by Subject Index, Technical Monitor, Responsible NASA organization, and RTOP number, is shown in Figure 2. It must be noted, as with the SSIE NRP, that the RTOP citation is an objective summary, and *not* a document. Again, the summary is a lead to future documentation.

W78-70120 **511-57-04**
Hugh L. Dryden Flight Research Center, Edwards, Calif.
ADVANCED TURBOPROP PROGRAM - FLIGHT TEST
W. G. Schweikhard 805-258-3311
(511-57-02)

The objective is to develop and demonstrate by flight tests the technology for advanced turboprop propulsion systems having high propulsion efficiencies at cruise speeds and altitudes up to Mach 0.8 and 35,000 feet. This technology could provide fuel savings of 20% to 25% relative to current high-bypass turbofan engines while meeting reliability requiremental and environments noise constraints. A two-feet diameter scale model of an advanced high tip speed propeller will be installed on a subsonic aircraft capable of flying Mach .8 at 30,000 feet altitude. Microphones will be placed on wing and fuselage, and acoustic flight test will be performed to obtain near field noise data. A feasibility study by one or more aircraft manufacturers will be performed to investigate the various approaches to evaluate advanced full-scale turooprop engines either as a testbed engine or as a replacement of existing aircraft engines.

Fig.2 Typical summary entry in NASA-RTOP

In Figure 3, the RTOP shown in Figure 2 is depicted as search output. Normally, search output from the RTOP file is limited to US organizations. Figure 3 is shown here for possible adaptation of the technique by other countries.

10.2.3 NASA Research & Development Contract Search File

Since 1972, NASA has been entering contract information on a special file on its overall data base. The contract file is simply a collection of summaries of NASA R & D contracts, grants, and orders. The file is searchable, online, by Corporate Source (contractor), Technical Monitor, Principal Investigator, Cognizant NASA Installation, Contract Number, and Subject Terms. Information in the file is available to NASA contractor personnel as a supplement to the ongoing research information contained in the RTOP file described above. A sample of the search citation from this file is shown in Figure 4.

Once again, the citation in Figure 4 is simply a summary; it provides a strong lead that documentation will be forthcoming under the contract number listed in the citation. (Note the entry "Reports Expected" in the eighth line of summary.)

```
   78W70120              511-57-04
   ADVANCED TURBOPROP PROGRAM - FLIGHT TEST
   SCHWEIKHARD, W. G.          805-258-3311
   NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. HUGH L. DRYDEN FLIGHT
RESEARCH CENTER, EDWARDS, CALIF.
   THE OBJECTIVE IS TO DEVELOP AND DEMONSTRATE BY FLIGHT TESTS THE
TECHNOLOGY FOR ADVANCED TURBOPROP PROPULSION SYSTEMS HAVING HIGH
PROPULSION EFFICIENCIES AT CRUISE SPEEDS AND ALTITUDES UP TO MACH 0.8
AND 35,000 FEET. THIS TECHNOLOGY COULD PROVIDE FUEL SAVINGS OF 20% TO
25% RELATIVE TO CURRENT HIGH-BYPASS TURBOFAN ENGINES WHILE MEETING
RELIABILITY REQUIREMENTAL AND ENVIRONMENTS NOISE CONSTRAINTS. A
TWO-FEET DIAMETER SCALE MODEL OF AN ADVANCED HIGH TIP SPEED PROPELLER
WILL BE INSTALLED ON A SUBSONIC AIRCRAFT CAPABLE OF FLYING MACH .8 AT
30,000 FEET ALTITUDE. MICROPHONES WILL BE PLACED ON WING AND FUSELAGE,
AND ACOUSTIC FLIGHT TEST WILL BE PERFORMED TO OBTAIN NEAR FIELD NOISE
DATA. A FEASIBILITY STUDY BY ONE OR MORE AIRCRAFT MANUFACTURERS WILL BE
PERFORMED TO INVESTIGATE THE VARIOUS APPROACHES TO EVALUATE ADVANCED
FULL-SCALE TURBOPROP ENGINES EITHER AS A TESTBED ENGINE OR AS A
REPLACEMENT OF EXISTING AIRCRAFT ENGINES.
   /*FUEL CONSUMPTION/*PROPULSION SYSTEM PERFORMANCE/*PROPULSIVE
EFFICIENCY/*TURBOFAN ENGINES/*TURBOPROP ENGINES
```

Fig.3 Example of RTOP computer search output

```
   77K11222      (MOD-000)NAS3-20406   505-01-34
   NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LEWIS RESEARCH
CENTER, CLEVELAND, OHIO.
   TRW SYSTEMS GROUP, REDONDO BEACH, CALIF.
   ANALYSES OF MOISTURE IN POLYMERS AND COMPOSITES
   UNCLASSIFIED          MAY 31, 1977 / MAY 30, 1978
   PI    B/GARDNER, M. P.
   REPORTS EXPECTED
   /*CARBON FIBER REINFORCED PLASTICS/*CARBON FIBERS/*CHEMICAL
ANALYSIS/*COMPOSITE MATERIALS/*EPOXY RESINS/*MECHANICAL
PROPERTIES/*MOISTURE/*MOISTURE CONTENT/*PHYSICAL
PROPERTIES/*PLASTICS/*POLYIMIDE RESINS/*POLYMERS/*REINFORCING
FIBERS/*THERMODYNAMIC PROPERTIES
```

Fig.4 Example of NASA R & D contract file; computer search output

10.2.4 Research and Technology Work Unit Information System (WUIS)

The WUIS is the US Department of Defense counterpart of the NASA RTOP. WUIS is a collection of technically oriented summaries describing research and technology projects currently in progress at the work unit level. The data bank consists of 20,000 active and about 90,000 terminated or completed summaries. Through this subfile, managers and researchers can remain abreast of research that is currently being performed and to assure that research efforts (and documentation) are not being duplicated. Summaries include project objective, funding data, current status, contract or grant information, performing organizations and names of key personnel and telephone numbers. This is a free service to registered US Government organizations and their associated contractors and subcontractors.

11. STAFFING, QUALIFICATIONS, AND TRAINING

11.1 Ideally, with funds permitting, the acquisitions function could be staffed with five employees with the Technical Document Evaluator, mentioned earlier, in charge of the group or the activity. Abbreviated position descriptions follow.

11.1.1 Technical Document Evaluator

The Technical Document Evaluator is responsible for the overall acquisitioning effort, including the direct supervision of the acquisitions group. Preferably, the Evaluator should have a degree in engineering, physics, chemistry or information science (with a minor in physics, chemistry or mathematics) with a minimum of five years of progressively responsible experience; one or more years' experience working with automated systems would be helpful. Host country language and a good working knowledge of the English language are mandatory. Supervisory and managerial ability must have been demonstrated.

11.1.2 Assistant Technical Document Evaluator

The qualifications for this position are the same as above, but to a slightly lesser degree. A minimum of three years of progressively responsible experience and a minimum of one year of experience with automated systems would be helpful.

11.1.3 Senior Acquisitioner

The Senior Acquisitioner selects and procures reference materials for acquiring technical documents. Must be able to scan accession lists, bibliographies, and abstract journals for relevant material for the data base system. A college degree, preferably in the subjects in 11.1.1 above, and previous experience in document processing activities and a working knowledge in two or more languages, including English, are desirable.

11.1.4 Acquisitions Clerks

Two Acquisition Clerks with typing capability are required for meticulous recordkeeping. Typing capability of 50 words per minute and a working knowledge of the host country and the English language are mandatory.

11.2 Initially, on the job training could consist of concentrated reading and scanning of abstract journals, accession lists, and bibliographies found in large technical libraries. This should be followed by orientation tours of nearby technical libraries or larger information processing systems such as ESA in Frascati, Italy, ZLDI in Germany, and the International Nuclear Information System in Vienna. The actual witnessing of an ongoing operation is often the best training technique available.

Appendix 1

NASA, ESA, ZLDI, AND COSATI SUBJECT CATEGORIES

AERONAUTICS

01 **Aeronautics (General)**

02 **Aerodynamics**
Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.
For related information see also 34 Fluid Mechanics and Heat Transfer.

03 **Air Transportation and Safety**
Includes passenger and cargo air transport operations; and aircraft accidents.
For related information see also 16 Space Transportation and 85 Urban Technology and Transportation.

04 **Aircraft Communications and Navigation**
Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.
For related information see also 17 Spacecraft Communications, Command and Tracking and 32 Communications.

05 **Aircraft Design, Testing and Performance**
Includes aircraft simulation technology.
For related information see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics.

06 **Aircraft Instrumentation**
Includes cockpit and cabin display devices; and flight instruments.
For related information see also 19 Spacecraft Instrumentation and 35 Instrumentation and Photography.

07 **Aircraft Propulsion and Power**
Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.
For related information see also 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels, and 44 Energy Production and Conversion.

08 **Aircraft Stability and Control**
Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 **Research and Support Facilities (Air)**
Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.
For related information see also 14 Ground Support Systems and Facilities (Space).

ASTRONAUTICS

12 **Astronautics (General)**
For extraterrestrial exploration see 91 Lunar and Planetary Exploration.

13 **Astrodynamics**
Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 **Ground Support Systems and Facilities (Space)**
Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.
For related information see also 09 Research and Support Facilities (Air).

15 **Launch Vehicles and Space Vehicles**
Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 **Space Transportation**
Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.
For related information see also 03 Air Transportation and Safety and 85 Urban Technology and Transportation.

17 **Spacecraft Communications, Command and Tracking**
Includes telemetry; space communications networks; astronavigation; and radio blackout.
For related information see also 04 Aircraft Communications and Navigation and 32 Communications.

18 **Spacecraft Design, Testing and Performance**
Includes spacecraft thermal and environmental control; and attitude control.
For life support systems see 54 Man/System Technology and Life Support. For related information see also 05 Aircraft Design, Testing and Performance and 39 Structural Mechanics.

19 **Spacecraft Instrumentation**
For related information see also 06 Aircraft Instrumentation and 35 Instrumentation and Photography.

20 **Spacecraft Propulsion and Power**
Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.
For related information see also 07 Aircraft Propulsion and Power, 28 Propellants and Fuels, and 44 Energy Production and Conversion.

CHEMISTRY AND MATERIALS

23 **Chemistry and Materials (General)**
Includes biochemistry and organic chemistry.

24 **Composite Materials**
Includes laminates.

25 **Inorganic and Physical Chemistry**
Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.
For related information see also 77 Thermodynamics and Statistical Physics.

26 **Metallic Materials**
Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 **Nonmetallic Materials**
Includes physical, chemical and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 **Propellants and Fuels**
Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.
For related information see also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, and 44 Energy Production and Conversion.

ENGINEERING

31 **Engineering (General)**
Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 **Communications**
Includes land and global communications; communications theory; and optical communications.
For related information see also 04 Aircraft Communications and Navigation and 17 Spacecraft Communications, Command and Tracking.

33 **Electronics and Electrical Engineering**
Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.
For related information see also 60 Computer Operations and Hardware and 76 Solid-State Physics.

34 **Fluid Mechanics and Heat Transfer**
Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.
For related information see also 02 Aerodynamics and 77 Thermodynamics and Statistical Physics.

35 **Instrumentation and Photography**
Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.
For aerial photography see 43 Earth Resources. For related information see also 06 Aircraft Instrumentation and 19 Spacecraft Instrumentation.

36 **Lasers and Masers**
Includes parametric amplifiers.

37 **Mechanical Engineering**
Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 **Quality Assurance and Reliability**
Includes product sampling procedures and techniques; and quality control.

39 **Structural Mechanics**
Includes structural element design and weight analysis; fatigue; and thermal stress.
For applications see 05 Aircraft Design, Testing and Performance and 18 Spacecraft Design, Testing and Performance.

GEOSCIENCES

42 **Geosciences (General)**

43 **Earth Resources**
Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see 35 Instrumentation and Photography.

44 **Energy Production and Conversion**
Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.
For related information see also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels, and 85 Urban Technology and Transportation.

45 **Environment Pollution**
Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 **Geophysics**
Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.
For space radiation see 93 Space Radiation.

47 **Meteorology and Climatology**
Includes weather forecasting and modification.

48 **Oceanography**
Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

51 **Life Sciences (General)**
Includes genetics.

52 **Aerospace Medicine**
Includes physiological factors; biological effects or radiation; and weightlessness.

53 **Behavioral Sciences**
Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 **Man/System Technology and Life Support**
Includes human engineering; biotechnology; and space suits and protective clothing.

55 **Planetary Biology**
Includes exobiology; and extra-terrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

59 **Mathematical and Computer Sciences (General)**

60 **Computer Operations and Hardware**
Includes computer graphics and data processing.
For components see 33 Electronics and Electrical Engineering.

61 **Computer Programming and Software**
Includes computer programs, routines, and algorithms.

62 **Computer Systems**
Includes computer networks.

63 **Cybernetics**
Includes feedback and control theory.
For related information see also 54 Man/System Technology and Life Support.

64 **Numerical Analysis**
Includes iteration, difference equations, and numerical approximation.

65 **Statistics and Probability**
Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 **Systems Analysis**
Includes mathematical modeling; network analysis; and operations research.

67 **Theoretical Mathematics**
Includes topology and number theory.

PHYSICS

70 **Physics (General)**
For geophysics see 46 Geophysics. For astrophysics see 90 Astrophysics. For solar physics see 92 Solar Physics.

71 **Acoustics**
Includes sound generation, transmission, and attenuation.
For noise pollution see 45 Environment Pollution.

72 **Atomic and Molecular Physics**
Includes atomic structure and molecular spectra.

73 **Nuclear and High-Energy Physics**
Includes elementary and nuclear particles; and reactor theory.
For space radiation see 93 Space Radiation.

74 **Optics**
Includes light phenomena.

75 **Plasma Physics**
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see 46 Geophysics. For space plasmas see 90 Astrophysics.

76 **Solid-State Physics**
Includes superconductivity.
For related information see also 33 Electronics and Electrical Engineering and 36 Lasers and Masers.

77 **Thermodynamics and Statistical Physics**
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also 25 Inorganic and Physical Chemistry and 34 Fluid Mechanics and Heat Transfer.

SOCIAL SCIENCES

80 **Social Sciences (General)**
Includes educational matters.

81 **Administration and Management**
Includes management planning and research.

82 **Documentation and Information Science**
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see 61 Computer Programming and Software.

83 **Economics and Cost Analysis**
Includes cost effectiveness studies.

84 **Law and Political Science**
Includes space law; international law; international cooperation; and patent policy.

85 **Urban Technology and Transportation**
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see 03 Air Transportation and Safety, 16 Space Transportation, and 44 Energy Production and Conversion.

SPACE SCIENCES

88 **Space Sciences (General)**

89 **Astronomy**
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 **Astrophysics**
Includes cosmology; and interstellar and interplanetary gases and dust.

91 **Lunar and Planetary Exploration**
Includes planetology; and manned and unmanned flights.

For spacecraft design see 18 Spacecraft Design, Testing and Performance. For space stations see 15 Launch Vehicles and Space Vehicles.

92 **Solar Physics**
Includes solar activity, solar flares, solar radiation and sunspots.

93 **Space Radiation**
Includes cosmic radiation; and inner and outer earth's radiation belts.

For biological effects of radiation see 52 Aerospace Medicine. For theory see 73 Nuclear and High-Energy Physics.

GENERAL

99 **General**

COSATI – SUBJECT FIELD AND GROUP STRUCTURE

Field 1. Aeronautics. Includes the following Groups: Aerodynamics; Aeronautics; Aircraft Flight Control and Instrumentation; Air Facilities.

Field 2. Agriculture. Includes the following Groups: Agricultural Chemistry; Agricultural Economics; Agricultural Engineering; Agronomy and Horticulture; Animal Husbandry; Forestry.

Field 3. Astronomy and Astrophysics. Includes the following Groups: Astronomy; Astrophysics; Celestial Mechanics.

Field 4. Atmospheric Sciences. Includes the following Groups: Atmospheric Physics; Meteorology.

Field 5. Behavioral and Social Sciences. Includes the following Groups: Administration and Management; Documentation and Information Technology; Economics; History, Law, and Political Science; Human Factors Engineering; Humanities; Linguistics; Man-machine Relations; Personnel Selection, Training, and Evaluation; Psychology (Individual and Group Behavior); Sociology.

Field 6. Biological and Medical Sciences. Includes the following Groups: Biochemistry; Bioengineering; Biology; Bionics; Clinical Medicine; Environmental Biology; Escape, Rescue, and Survival; Food, Hygiene and Sanitation; Industrial (Occupational) Medicine; Life Support; Medical and Hospital Equipment; Microbiology; Personnel Selection and Maintenance (Medical); Pharmacology; Physiology, Protective Equipment; Radiobiology; Stress Physiology; Toxicology; Weapon Effects.

Field 7. Chemistry. Includes the following Groups: Chemical Engineering; Inorganic Chemistry; Organic Chemistry; Physical Chemistry, Radio and Radiation Chemistry.

Field 8. Earth Sciences and Oceanography. Includes the following Groups: Biological Oceanography; Cartography; Dynamic Oceanography; Geochemistry; Geodesy; Geography; Geology and Mineralogy; Hydrology and Limnology; Mining Engineering; Physical Oceanography; Seismology; Snow, Ice, and Permafrost; Soil Mechanics; Terrestrial Magnetism.

Field 9. Electronics and Electrical Engineering. Includes the following Groups: Components; Computers; Electronic and Electrical Engineering; Information Theory; Subsystems; and Telemetry.

Field 10. Energy Conversion (Non-propulsive). Includes the following Groups: Conversion Techniques; Power Sources; Energy Storage.

Field 11. Materials. Includes the following Groups: Adhesives and Seals; Ceramics, Refractories, and Glasses; Coatings, Colorants, and Finishes; Composite Materials; Fibers and Textiles; Metallurgy and Metallography; Miscellaneous Materials; Oils, Lubricants, and Hydraulic Fluids; Plastics; Rubber; Solvents, Cleaners, and Abrasives; Wood and Paper Products.

Field 12. Mathematical Sciences. Includes the following Groups: Mathematics and Statistics; Operations Research.

Field 13. Mechanical, Industrial, Civil, and Marine Engineering. Includes the following Groups: Air Conditioning, Heating, Lighting, and Ventilating; Civil Engineering; Construction Equipment, Materials, and Supplies; Containers and Packaging; Couplings, Fitting, Fasteners, and Joints; Ground Transportation Equipment; Hydraulic and Pneumatic Equipment; Industrial Processes; Machinery and Tools; Marine Engineering; Pumps, Filters, Pipes, Fittings, Tubing, and Valves; Safety Engineering; Structural Engineering.

Field 14. Methods and Equipment. Includes the following Groups: Cost Effectiveness; Laboratories, Test Facilities, and Test Equipment; Recording Devices; Reliability; Reprography.

Field 15. Military Sciences. Includes the following Groups: Antisubmarine Warfare; Chemical, Biological, and Radiological Warfare; Defense; Intelligence; Logistics; Nuclear Warfare; Operations, Strategy, and Tactics.

Field 16. Missile Technology. Includes the following Groups: Missile Launching and Group Support; Missile Trajectories; Missile Warheads and Fuses; Missiles.

Field 17. Navigation, Communications, Detection, and Countermeasures. Includes the following Groups: Acoustic Detection; Communications; Direction Finding; Electromagnetic and Acoustic Countermeasures; Infrared and Ultraviolet Detection; Magnetic Detection; Navigation and Guidance; Optical Detection; Radar Detection; Seismic Detection.

Field 18. Nuclear Science and Technology. Includes the following Groups: Fusion Devices (Thermonuclear); Isotopes; Nuclear Explosions; Nuclear Instrumentation; Nuclear Power Plants; Radiation Shielding and Protection; Radioactive Wastes and Fission Products; Radioactivity; Reactor Engineering and Operation; Reactor Materials; Reactor Physics; Reactors (Power); Reactors (Non-power); SNAP Technology.

Field 19. Ordnance. Includes the following Groups: Ammunition, Explosives, and Pyrotechnics; Bombs; Combat Vehicles; Explosions, Ballistics, and Armor; Fire Control and Bombing Systems; Guns; Rockets; Underwater Ordnance.

Field 20. Physics. Includes the following Groups: Acoustics; Crystallography; Electricity and Magnetism; Fluid Mechanics; Masers and Lasers; Optics; Particle Accelerators; Particle Physics; Plasma Physics; Quantum Theory, Solid Mechanics; Solid-state Physics; Thermodynamics; Wave Propagation.

Field 21. Propulsion and Fuels. Includes the following Groups: Air-breathing Engines; Combustion and Ignition; Electric Propulsion; Fuel; Jet and Gas Turbine Engines; Nuclear Propulsion; Reciprocating Engines; Rocket Motors and Engines; Rocket Propellants.

Field 22. Space Technology. Includes the following Groups: Astronautics; Spacecraft; Spacecraft Trajectories and Reentry; Spacecraft Launch Vehicles and Ground Support.

Appendix 2

SELECTED DEFINITIONS & ACRONYMS

Acquisition (AGARD-AG-182-Pt-1)
Same as accession.
(1) A document or piece of information that has been added to a collection.
(2) The process of procuring a document for a collection.

Analytical Entry (AGARD-AG-182-Pt-1)
An entry in a catalogue, bibliography, or index for an item in a document, including a reference for that document.

Case File (Author-supplied)
A file consisting of the archival accessioned document or its surrogate and all related processing papers. Case file folders are filed in numerical sequence by series.

COM (Worldwide)
Computer Output Microfilm: microfilm containing data, produced by a recorder from computer-generated electrical signals.

Corporate Source (or Corporate Author) (AGARD-AG-182-Pt-1)
The group or corporation responsible for the publication of a book or document.

COSATI (USA)
Committee on Scientific and Technical Information

Document (AGARD-AG-182-Pt-1)
A record in any form from which information may be derived, e.g., a page containing data, a graphic representation, a tape recording, or a book.

Document surrogate (Author-supplied)
A condensed record to represent a document in printed form, in microform, or in a machine-readable medium containing bibliographic data for a citation and abstract or contents note.

Duplicates (Author-supplied)
A *bibliographic duplicate* is an exact replica of another in content.
A *pseudo-duplicate*, found mostly in periodicals or serials, is an article by the same author, on the same subject but with some differences such as date, length, etc., as compared to another article. In some cases the title is modified or tailored to fit the serial in which the article is to be published.
A *translation duplicate* is a translation of a report or an article into another language.

DDC (DOD/USA)
Defense Documentation Center

DOD (USA)
Department of Defense

DRIC (UK)
Defence Research Information Centre

DSIS (Canada)
Defence Scientific Information Service

EAPA (ERDA/USA)
Energy Abstracts for Policy Analysis

ERA (ERDA/USA)
Energy Research Abstracts

ERDA (USA)
Energy Research and Development Administration

ESA (Europe)
European Space Agency

GPO (USA)
Government Printing Office

GRAI (NTIS/USA)
Government Reports Announcements & Index

IAA (USA)
International Aerospace Abstracts

KWIC (AGARD-AG-182-Pt-2)
Keyword in Context index. A listing, usually of document titles in which each significant word is shown in alphabetical order in a column, with some context which may precede and follow it.

NASA (USA)
National Aeronautics and Space Administration

NRP (SSIE/USA)
Notice of Research Projects

NSA (ERSA/USA)
Nuclear Science Abstracts (superseded by EAPA and ERA – see definitions above)

NTIS (USA)
National Technical Information Service

RTOP (NASA/USA)
Research and Technology Objectives and Plans (Summary)

SSIE (USA)
Smithsonian Scientific Information Exchange

STAR (NASA/USA)
Scientific and Technical Aerospace Reports

Text Search (Author-supplied)
Text Search is a computer technique to retrieve document records based on natural language – the natural language used for duplicate searching is normally limited to the title.

TRC (UK)
Technology Reports Centre. R & D Abstracts.

WUIS (DOD/USA)
Work Unit Information System

ZLDI (FRG)
Zentralstelle für luft- und Raumfahrt-Dokumentation und Information.

Appendix 3

SELECTED ADDRESS LIST FOR DOCUMENT PROCUREMENT*

Australia
CSIRO Central Library & Information
Service 314 Albert Street
East Melbourne, VIC 3002, Australia

Austria
International Atomic Energy Agency (IAEA)
P.O. Box 590
A-1011, Vienna, Austria

Library of the University of Technology
Karlsplatz 13
Vienna IV, Austria

Belgium
Centre National de Documentation
Scientifique et Technique (CNDST)
Boulevard de l'Empereur 4
B-1000 Brussels, Belgium

Von Kármán Institute for Fluid Dynamics
VKI Library
Chaussée de Waterloo, 72
B-1640 Rhode-Saint-Genèse, Belgium

Canada
Defence Scientific Information
Service
Ottawa, Ontario, Canada KA1 OK2

Information Canada
Canadian Government Printing Bureau
45 Sacred Heart Boulevard
Hull, Quebec, Canada K1A OS7

International Civil Aviation Organization
Library
1080 University Street
Montreal 101, P. Que., Canada

University of Calgary
Information Systems, Library, UNICIS
2920-24 Avenue, N.E.
Calgary, Alberta, Canada T2N 1N4

Denmark
Atomic Energy Research Establishment
Riso
Library
Riso, pr. Roskilde, Denmark

Finland
Helsinki University of Technology
Library
SF 02150 Otaniemi, Finland

France
Aluminum Pechiney
Service Documentation
Centre de Recherches
B.P.24-38340-Voreppe, France

Centre de Documentation de l'Armement
26 Boulevard Victor
75996 Paris Armées, France

Germany, Federal Republic of
Bundesministerium für Forschung
und Technologie (BMFT)
Postfach 120370
5300 Bonn 12
Federal Republic of Germany

Physikalische Berichte
i. Hs. c/o Physikalische Technische
Bundesanstalt
D-33, Braunschweig, Bundesallee 100
Germany

Technische Informationsbibliothek
Welfengarten 1B
D-3000 Hanover 1, Germany

Zentralstelle für Luft- und Raumfahrt-
dokumentation und -information
c/o Fachinformationszentrum Energie,
Physik, Mathematik GmbH
Kernforschungszentrum
7514 Eggenstein-Leopoldshafen 2

Italy
ESA-Space Documentation Service
ESRIN
Via Galileo Galilei
00044 Frascati (Rome) Italy

NATO SACLANT Antisubmarine Warfare
Research Centre
SACLANTCEN Scientific & Technical Information
Viale San Bartolomeo 400
19026 La Spezia, Italy

Japan
National Aerospace Laboratory
Library
1880 Jindaiii machi, Chofu shi
Tokyo, Japan

Luxemburg
Commission of the European Communities
European Nuclear Documentation Service (ENDS)
29 Rue Aldringen
Luxemburg

Netherlands
DSM, Centrale Bibliothek
P.O. Box 18
Geleen, The Netherlands

Eindhoven University of Technology
Library
P.O. Box 513
Eindhoven, The Netherlands

European Translations Centre (ETC)
Doelenstraat 101
Delft, The Netherlands

* For a more detailed listing, see Reference 9 in Appendix 6 of this paper.

Netherlands (continued)
Technisch Documentatie-en Informatie-Centrum
voor de Krijgsmacht (TDCK)
The Hague, The Netherlands

South Africa
Council for Scientific & Industrial Research (CSIR)
P.O. Box 395
Pretoria, S.Africa 0001

Sweden
Aeronautical Research Institute of Sweden (FFA)
Library
Box 11021
S-161 11 Bromma 11, Sweden

Research Institute of National Defence (FOA)
S-10450
Stockholm 80, Sweden

Royal Institute of Technology (RIT)
Library-Documentation Department
S-10044 Stockholm, Sweden

United Kingdom
AERE, Harwell, UK
Heat Transfer & Fluid Flow Service
HTES Bldg., 392 AERE, Harwell, Didcot.
Berkshire, UK

Aircraft Research Establishment
Manton Lane
Bedford MK 41 7PF, UK

British Library Lending Division
Boston Spa, Wetherby, Yorkshire
UK

Cranfield Institute of Technology
Library
Cranfield, Bedford, UK

Defence Research Information Centre
St Mary Cray, Orpington
Kent BR5 3RE, UK

Geomechanics Information Center
Imperial College of Science & Technology
Rock Mechanics, Prince Consort Road
London SW7, UK

Her Majesty's Stationery Office
P.O. Box 569
London S.E.1, UK

Microinfo Limited
4 High St., Alton, Hampshire,
GU34 1BA, UK
(UK Agent for NTIS)

Scientific Documentation Centre, Ltd
Halbeath House
Dunfermline, Fife, KY 12 OTZ, UK

Technology Reports Centre
Orpington, Kent BR5 3RF
UK

University Microfilms, Ltd.
Tylers Green
London, UK

United States
American Institute of Aeronautics and Astronautics
Technical Information Service
750 Third Ave.
New York, N.Y. 10017

Commissioner of Patents
US Patent Office
Washington, DC 20231

Department of Agriculture
National Agricultural Library
Beltsville, MD 20705

Department of Energy
Technical Information Center
P.O. Box 62
Oak Ridge, Tennessee 37830

John Crerar Library
National Translations Center
35 West 32nd St.
Chicago, Illinois 60616

Library of Congress
Science and Technology Division
Washington, D.C. 20540

National Aeronautics and Space Adminstration
Scientific and Technical Information Office (NST-10)
Washington, D.C. 20546

NASA Scientific and Technical Information Facility
P.O. Box 8757
B.W.I. Airport, MD 21240

National Library of Medicine
Bethesda, MD 20014

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

Pendragon House, Inc.
899 Broadway Avenue
Redwood City, CA 94063

Smithsonian Scientific Information Exchange
1730 M Street, N.W.
Washington, DC 20036

Superintendent of Documents
US Government Printing Office
Washington, DC 20402

US Geological Survey
Bldg. 25, Denver Federal Center
Denver, Colorado 80225

US Geological Survey
601 E. Cedar Avenue
Flagstaff, Arizona 86002

US Geological Survey
345 Middle Field Road
Menlo Park, CA 94025

US Geological Survey
1033 General Services Administration Building
Washington, DC 20242

University Microfilms
A Xerox Company
300 North Zeeb Road
Ann Arbor, Michigan 48106

Appendix 4

SAMPLE REQUEST FORM FOR AUTOMATIC DISTRIBUTION

IN REPLY REFER TO:

Gentlemen:

The would appreciate receiving two copies of the formal scientific and technical reports to be issued subsequently under the following contract:

We believe that subject reports will contribute greatly to the basic knowledge necessary in the research and development programs under way in and will result in comparable feed back to your programs.

The reports should be addressed as follows:

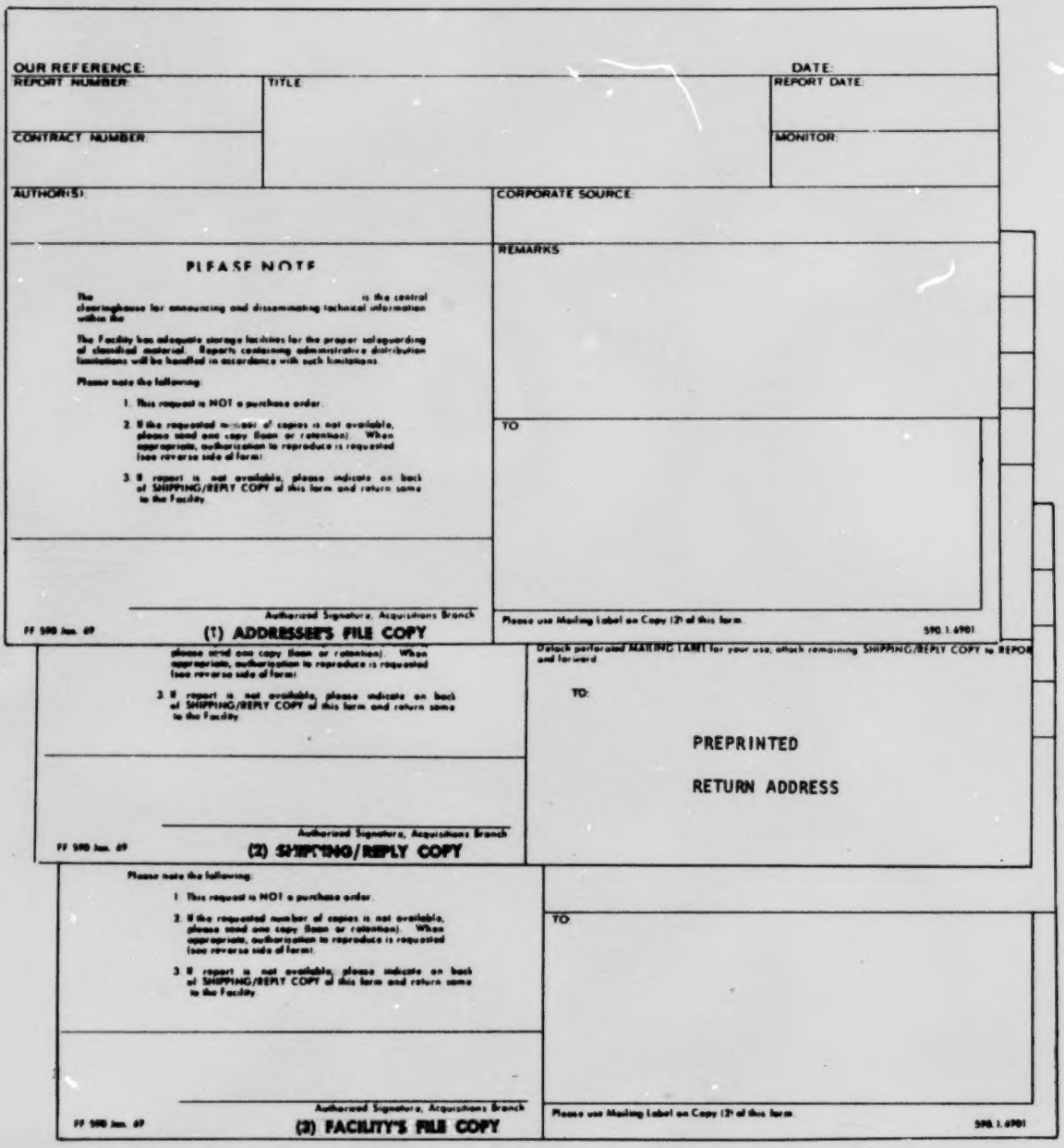
We wish to assure you that the reports will be handled and safeguarded in accordance with the security and/or administrative markings which are carried on them individually or collectively.

Your cooperation in effecting this distribution will be appreciated.

Sincerely yours,

Appendix 5

SAMPLE REQUEST FORM FOR SPECIFIC DOCUMENT



OUR REFERENCE:

DATE:

REPORT NUMBER:

TITLE

REPORT DATE:

CONTRACT NUMBER:

MONITOR:

AUTHOR(S):

CORPORATE SOURCE:

PLEASE NOTE

The is the central clearinghouse for announcing and disseminating technical information within the

The Facility has adequate storage facilities for the proper safeguarding of classified material. Reports containing administrative distribution limitations will be handled in accordance with such limitations.

Please note the following:

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(3) FACILITY'S FILE COPY

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Appendix 6

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Section 2

DESCRIPTIVE CATALOGING

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ABSTRACT

The functions and purposes of descriptive cataloging as applied to processing technical report literature are defined and the comparative merits of manual vs. automated systems are discussed. The descriptive data elements are listed and guidelines presented for their employment in the implementation of a system. The presentation draws heavily on the consolidated experience of large documentation centers in the United States and is designed to apply to either a system presently automated or which may be automated in the future. The personnel and staffing considerations are discussed. This section is primarily concerned with the data elements required in processing technical reports, although it does contain a conversion table to indicate the relationship to data elements used in conventional cataloging.

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1. INTRODUCTION

1.1 "The prime function of secondary information services is to inform their users of the existence of relevant documents, and to provide this information in such a form as to enable the user (a) to retrieve relevant references (b) to assess the likely value of the documents referred to and (c) to obtain original documents on the basis of the references given."[1] Descriptive cataloging is the tool for accomplishing this service. It can be defined as that part of the cataloging process which completely describes and identifies a report document or book, the objectives being "(1) to state the significant features of an item with the purpose of distinguishing it from other items and describing its scope, contents, and bibliographic relation to other items: (2) to present these data in an entry which can be integrated with the entries for other items in the catalog and which will respond best to the interests of most users of the catalog."[2]

1.1.1 This can best be accomplished by selecting and recording those items of information about a piece of literature that will uniquely identify it, and including those items of information in indexes so they will be retrievable. Indexes can be cumulated for any type of data deemed desirable by the user, for example, report number, personal author, or date.

1.2 This description of a piece of literature may be called bibliographic description, bibliographic record, reference, a citation, or a unit record. It is essential that this unit record be compiled in a uniform way. Lack of uniformity by catalogers in the selection and arrangement of entries for the document unit record is one of the prime causes of inefficiency in any document retrieval system.

1.3 The items of information thus collected are variously referred to as data elements, descriptive elements, cataloging elements or bibliographic elements. For consistency in this work, the term "data elements" will be used to refer to information which is to be cataloged.

2. FUNCTIONS AND PURPOSES OF BIBLIOGRAPHIC DESCRIPTION

2.1 The primary function of bibliographic description is to provide an accurate and specific record of the data elements that uniquely identify a document. The record should give all those data elements that permit the user to distinguish between two similar publications. For example, there might be in the same file two editions of a report. The editions would carry the same author, title and issuing source, but the differing dates of publication would enable the user to identify the later version. The number of data elements needed for this purpose is not large.

2.1.1 An additional purpose is to provide information about the document needed by the users. While a document can be uniquely identified with a limited number of data elements, the users frequently want to have information about the document without the necessity of consulting the document itself. The kind and degree of supplemental information included in the bibliographical description will depend on the nature of the documents and on the requirements of the users. Paragraph 4.2 lists some data elements which have been found useful by some organizations; however, other organizations may have needs that require the addition of other types of information.

2.2 The data provided about the document should be in standardized form, for ease of use. The user of a file of bibliographic records will expect to find like kinds of information presented in like manner. For example, he will expect to find an author's name always given as "Smith, Charles T;" rather than "Charles T.Smith," when it appears as a main entry. Furthermore, he might expect to find the principal author's name always occupying the same place on a catalog card.

2.3 Retrieval points must be established for certain items of information which are used both in the bibliographic description of a document and in the preparation of indexes for the retrieval of documents. If the bibliographic records are being used in a card catalog, a specific record may be found in various parts of the catalog filed according to specific items of information found on the catalog card, e.g., the personal author, the corporate author, the title, the report number. In a multiple approach catalog, one entry is as good as another in locating a work, and the designation of entries as being "main" or "added" serves little purpose.

2.3.1 As mentioned above, it is essential that this information be supplied in a standardized, consistent way so that like items will file with like in a card catalog and so that retrieval can be accomplished from a computer system.

3. METHODS OF INPUT

3.1 Descriptive cataloging was traditionally considered as the activity that resulted in a card catalog produced by typewritten cards, hand-filed. Today, with the increasing use of computers, many bibliographic files are produced by the use of inputting devices (e.g., key-punch machines, on-line terminals) that give machine readable records. These records are manipulated in a computer to give copy for a book catalog, or catalog cards (which can then be hand-filed), for, in the case of more sophisticated systems, a computer file that can be searched on line. Both methods of input have their limitations and advantages.

3.1.1 Production and maintenance of a card catalog by traditional methods is time-consuming and expensive for larger organizations with a large volume of work. However, for smaller organizations it may be the most efficient system as it could be managed with a minimum of trained personnel and sophisticated equipment.

3.1.2 The principal advantage of a machine system is, of course, the speed with which the bibliographic reference becomes searchable and/or the printed cards become available for filing in the card catalog. The data can be manipulated for many types of output. One disadvantage is the extreme difficulty in retrieving unless rigid standards of consistency are followed in the selection of data elements for cataloging and in the form in which the cataloging data are entered into the machine system. Prime disadvantages are the initial expense, higher operating expense and the necessity for trained specialists. New small computers requiring little training to operate and less initial expense may be the answer for some organizations.

3.1.3 An additional reason for consistency, if indeed there need be any other, is the possibility that the manual system of today will become automated in the future. Therefore, it is prudent when developing manual systems to design them for maximum ease in conversion at a future data to automated systems. This can easily be done by insisting from the outset on a strict adherence to all the format styles and standards of data element entries. Needless to say, it precludes the relaxation of these standard procedures regardless of the merits of an individual case.

4. LIST OF DATA ELEMENTS

4.1 The concept of a data element is not one on which there is unanimity. The greatest inconsistencies result from differences in specificity of the data included in one data element. An example is the information in the imprint of a book. In some systems the imprint would be a single data element. In other systems the information might be divided among three data elements: place of publication, name of publisher, and date. Even a date can lend itself to further division: day, month, year. As noted earlier, in a manual system, this matter of specificity does not matter. In an automated system, where each item must be standardized and tagged, data elements must be specifically identified and entered consistently. Examples of data element lists currently in use are UNISIST* and INIS**. The data elements given in this manual are those that apply primarily to unpublished reports, rather than to the types of literature, i.e., books and journals, normally found in conventional libraries. While these data elements are relatively specific, it should be remembered that several can be combined if that better meets requirements of the local cataloging system. The order in which the data elements are presented has no particular significance. If the cataloging is part of a manual system that uses a catalog card, the format of the card will determine the order in which the data elements appear.

4.2 The list of data elements shown in Figure 1 constitutes an adequate unit record for most types of scientific and technical literature commonly cataloged by secondary information services. It is possible, of course, for a document to fall into several of the categories listed. In that case, the cataloger would include any of the data elements that were given on the piece. The data elements are described in more detail in Paragraph 4.4.

4.3 It will be apparent immediately to traditional documentalists that these elements, many of which were established by the Committee on Scientific and Technical Information (COSATI)[3/4], do not conform to standard library cataloging rules. In conventional cataloging, the elements listed in the COSATI *Standards for Descriptive Cataloging of Government Scientific and Technical Reports* might be equated as follows:[5]

COSATI Element	*Equivalent in Conventional Cataloging*
†Accession number	Call (location) number or series number
†Corporate author	Main entry, added entry, or publisher and place published
†Title	Title statement or title added entry
Descriptive note	Subtitle
†Personal author	Main entry, added entry, or author statement
Date	Date in the imprint statement
Pagination	Number of pages in the collation statement
†Contract number	Note
†Report number	Call (location) number or series number
Availability	Note
Supplementary note	Note
Security Classification	Note

---

* United Nations Educational, Scientific and Cultural Organization, Paris.

** International Atomic Energy Agency, Vienna.

† Also index entries in the COSATI scheme.

Field or Tag Number	*Data Element*	*Conferences*	*Classified Reports*	*Unclassified Scientific & Technical Reports*	*Reprints from Published Literature*	*Translations*	*Patents*	*Books*
01	Accession Number	x	x	x	x	x	x	
02	Corporate Author		x	x	x	x	x	
03	Price			x				
04	Title (Unclassified)	x	x	x	x	x	x	x
05	Conference Title	x						
06	Descriptive Note or Subtitle		x	x				x
07	Classification of Title		x					
08	Classified Title		x					
09	Author(s), Inventor(s)		x	x	x	x	x	x
10	Date of Publication	x	x	x	x	x	x	x
11	Date of Reclassification		x					
12	Pagination	x	x	x	x	x	x	x
13	Report Numbers, Patents ISBN, ISSN		x	x		x	x	x
14	Contracts, Grants, Orders		x	x				
15	Program Element, Projects, Tasks, Work Units		x	x				
16	Acronym of Government or Military Sponsor		x	x				
17	Report Number of Government Sponsor		x	x				
18	Security Classification of Document	x	x	x	x	x	x	x
19	Supplemental Information or Notes	x	x	x	x	x	x	x
20	Distribution Limitations		x	x				
21	Availability Statements		x	x	x	x		
22	Classification Authority		x					
23	Date of Declassification		x					
24	Translator					x		
25	Code for Reclassification		x					
26	Code for Distribution/ Availability		x	x	x	x	x	
27	Corporate Author Code		x	x	x	x	x	

Fig. 1 List of cataloging elements/types of documents

4.3.1 Although there is *not* a one-to-one conversion between the two schemes, most of the traditional entries could be converted into COSATI data elements if this is desired, or vice versa. However, since conventional cataloging would not permit machine retrieval of many of the elements considered essential in scientific and technical report cataloging, it would seem that a COSATI-type scheme would be practical for a documentation center specializing in unpublished technical reports. In the first place, this format or an adaptation of it is used in the US by large processors such as National Technical Information Service, Defense Documentation Center, Environmental Protection Agency, National Aeronautics and Space Administration and Department of Energy, as well as many special libraries. It provides a standard for bibliographic exchange through interchange of tapes, already taking place. In addition, the COSATI panels have published several guidelines and other instructional manuals. Those which are germane to this presentation will be cited at the appropriate points.

4.3.2 Two principal differences between the COSATI scheme and traditional cataloging are the COSATI use of corporate authors as main entries and the inclusion of various numbers that are meaningful on reports of government or privately sponsored research. Some identifying numbers that might apply to such documents, in addition to the data elements listed above, are: Series number, Volume number, Issue number, Part number, Supplement number, Change number, Edition number, Abstract number, Bibliography number, Library card number, ISBN*, ISSN**, Registration number, Publisher's number, work identification number, document serial number and patent application number.

4.3.3 By assigning different data element numbers (or field numbers) to those identifying numbers, they can be included or excluded for indexes as desired. They can, of course, also be included as part of other data element fields.

4.4 Definitions of Data Elements:

01 – Accession Number. An accession number is assigned to an acquisition for purposes of control by the specific organization performing the cataloging. The number may be newly assigned, may be the accession number assigned by a documentation center, or may be the document number assigned either by the originating organization or the monitoring organization, depending on the practice of the organization performing the cataloging.

02 – Corporate Author. The corporate author is the name of the institutional or corporate body preparing the report, or deemed responsible editorially/contractually for its content. While it does not necessarily have to be considered the main entry, it will unquestionably be a major reference access point in either a manual or automated system. A corporate author authority file is mandatory for maintaining consistency, and provision for one should be made whenever a new document center is established. Existing standards such as conventional rules – those established by COSATI or any other combination useful to the local organization – should be used, but it would be prudent to provide at the outset for machinability. This can be done by assigning a multidigit numeric or other suitable code for each source either for immediate or future use. The COSATI rules for corporate authors (sources) follow the pattern outlined below and it is felt that with local improvisation they can be useful in filling the needs of many different types of organizations.

(1) The geographic location of the body is always included.

(2) Only two organizational elements may be included.

(3) The order of the elements should be – largest element, place name, smallest element.

(4) US is omitted before government headings.

(5) The report series number can influence or govern the establishing of the name.

See Appendix A for a more extensive explanation of the COSATI rules for establishing corporate authors and suggestions for setting up a corporate author authority file.

03 – Price – may be omitted if not pertinent.

04 – Title should usually be taken from the title page. For machine entry, it may be advisable to rearrange the title for consistency, and therefore, more successful retrieval. Some standards practiced by the COSATI method are as follows:

(a) If part of the title has subject content, and part is a descriptive note, use the true title as title followed by the descriptive note. This data element may be cataloged as a separate data element in another field.

Example: Quarterly Progress Report on Radar Tracking.
Use as title: Radar Tracking.
Quarterly progress report.

(a.1) An exception to above would be a classified document on which the originator had indicated an apparent descriptive note as the only unclassified title.

(a.2) A title should be meaningful, if possible; however, if only a descriptive note or subtitle is given, it may be used as the title.

---

* International Standard Book Number

** International Standard Serial Number

(b) Add punctuation to title to make the meaning clearer, but only when necessary.

(c) Dates appearing in the title should remain as displayed in the report's title.

(d) Titles of conferences, etc., may be rearranged to permit more meaningful interfiling by deleting the number of the conference in the beginning and adding the number in parentheses after the name of the conference.

Example: Sixth Army Human Factors Conference becomes Army Human Factors Conference (6th).

(e) Handling of numbers in titles: When volume, part, book, etc., numbers appear, use either Roman or Arabic numerals as given on the report. When the volume, part, book, etc., is spelled out in the title, translate to Arabic numbers.

Example: Document reads: Volume III, Book One.
Catalog as: Volume III, Book 1.

(f) If the report is in a foreign language and the title is given in both the native language and a foreign language, list first the title given in the foreign language, followed by the title given in the native language enclosed in parentheses. If part of the text of the report is in the native language, list first the title given in the native language, followed by the title given in the foreign language enclosed in parentheses. If the text and title are only in a foreign language, the title should be translated if possible, unless the title is also the name of a foreign periodical. If the title is given in more than one foreign language, use first the language that reflects the language of the text.

(g) Examples for Cataloging of Foreign Title.

Document Digest 1976. Volume 13, Number 1 (Bulletin Signaletique 1976. Volume 13, Numero 1).

Proceedings of the Symposium on the Oceanography and Fisheries Resources of the Tropical Atlantic, Abidjan, 20–28 October 1966, Ivory Coast (Actes du Symposium sur l'Oceanographie et les Ressources Helieutiques de l'Atlantique Tropical Abidjan, 20–28 Octobre 1966, Cote d'Ivoire).

Ueber Forschungsarbeiten der DFVLR auf dem Gebiet der Flugsicherheit (Flight Safety Work and the DFVLR).

(h) Capitalization: A capital is used as the initial letter of all words in titles except prepositions, conjunctions, articles and scientific names for plants and animals (may be modified to conform with national convention).

In scientific terminology, Latin names for plants and animals are shown in italic type. In typewritten papers, the names are underscored. In either instance, for computer entry, enclose the scientific name with single quotation marks. Commonly accepted usage by the scientific community is that the genus name is capitalized, and the species name is lowercased:

'Rosa caroliniana'
'Styrax californica'
'R. caroliniana'

Subspecies and variations are also lowercased:

'Trogon Collaris puella'
'Cypripedium parviflorum' var. 'pubescens'

(i) Example for handling changes to basic documents: Use the title as shown on the basic document. Add change number to title and report number. In supplemental note, Change 1 to .....

AD-B017 17/2, 9/2
COMMAND AND CONTROL TECHNICAL CENTER WASHINGTON D C
77-12
JOINT OPERATION PLANNING SYSTEM (JOPS)
DEPLOYMENT DATA (DEPDA) FILE. USERS MANUAL.
CHANGE 1.
26 OCT 76 65P REPT. NO.
CCTC-J7204-UM-DEPDA-CHANGE 1
UNCLASSIFIED REPORT
CHANGE 1 TO REPORT DATED 1 MAY 76, AD-B013 371L.
DISTRIBUTION LIMITED TO US GOVT. AGENCIES
ONLY; TEST AND EVALUATION; 6 MAY 76. OTHER
REQUESTS FOR THIS DOCUMENT MUST BE REFERRED TO
DIRECTOR, COMMAND AND CONTROL TECHNICAL CENTER,
ATTN: CODE C327. WASHINGTON, D.C.20301.

05 – Conference Title. Names of conferences should be entered in a standardized way, so all papers from conference will file together.

06 – Descriptive note or sub-title. May be included in the same data element with the title, or listed separately in another field.

Examples:

Addendum A to Final rept.
Bibliography
Contract rept.
Computer systems manual
Doctoral thesis
Final rept. (Part C), 1 Sep 74-31 Mar 75
Final engineering rept. for 1970
Final technical rept. 24 Feb 73-23 Feb 74 on Phase 2
Group study project
Master's thesis
Memorandum rept.
Progress rept. no 12 (Final)
Quarterly progress rept. no.4, 1 Mar–31 May 76
Report bibliography
Rept. no.4 (Annual)
Rept. no.5 (Final)
Research memo.
Research note for period ending 12 Jan 77
Research paper
Research rept.
Research study
Special publication
Special rept.
Supplement to interim rept. no.3
Technical document
Technical memo.
Technical operating rept. for Jan 71
Technical publication
Technical rept. on Phase 3
Technical rept. no 2, 1 Jun 75–1 Jun 76

07 – Classification of Title. When the classification of a title of a classified document is not indicated, the cataloging organization must determine whether it will consider it to be the same as the report itself or make a judgement in each individual case. Obviously the policy on this point must be made locally in accordance with local security regulations.

08 – Classified Title. Classified titles may be listed on an on-line system with security safeguards, but not on catalog cards, unless the catalog is classified. When the only title given is classified, the card in an unclassified manual catalog must show only "Classified Title" in the title space.

09 – Personal Author(s). This data element may include inventors, editors, or any other persons responsible for a work. The number of authors may be limited by space or machine entry in computer oriented systems. Titles or rank of individuals may be included or excluded, as desired. Forenames and surnames have to be separately identified if, from one input, the name is to be generated in natural order (as in an author statement or author by-line) and in inverted order (as in an index or entry in a catalog).

10 – Date of Publication. Dates may be given in a variety of forms, depending on local custom. The COSATI format is, for example, 15 Dec 77. An all-number format might be used, for example, 151277.

11 – Date of Next Reclassification. Some classification procedures require that documents be assigned a date when the security classification will again be considered for either continuation, downgrading or declassification. Control records should be maintained for this purpose. More specific information on security controls is given in Appendix B and also will be included in Section 10 of the manual.

12 – Pagination. COSATI differs from conventional cataloging in that all pages, including the cover, are counted instead of counting the preface separately. One of the reasons for this is that the page count will conform with the number of microfiche frames necessary to photograph the document. In cases where copies of the report are to be sold, page count is frequently the basis for establishing the price.

13 – Report Numbers. As stated previously, there are many numbers which may be unique to a document and would serve as a retrieval point. These might be listed together as one data element, or each type of number might be a different data element, depending on local need.

14 – Contracts, grants, and work orders issued by government and official organizations (transfer of funds information) may be cataloged either as the same data element or separately.

15 – The US Military Standard (MIL-STD 847A)[6] requires the entry of funding accountability numbers (in the form of Program Element, Project, Task and Work Unit numbers) on the report documentation page required for submission with technical reports, both in-house and contracted. These are currently listed as part of the unit record in individual fields.

16 – Acronyms of the sponsoring government or military organization or headquarters, or a national documentation center, e.g., Defence Research Information Centre (DRIC), may be listed as a separate element.

17 – Serial report numbers accompanying the acronyms listed above may be cataloged separately or with the acronyms.

18 – It is imperative that any cataloging record of a document carry the overall security classification of that document (for example, Top Secret, Secret, Confidential, Restricted or Unclassified). Additional restrictions such as RD (Restricted Data) or FRD (Formerly Restricted Data) must be indicated.

19 – A field for supplemental information could be used for those kinds of information normally included as added entries and notes in conventional cataloging.

20 – If a document has any distribution limitation, that information should be prominently displayed on any unit record, either card or computer display.

21 – Availability Statements. Since technical and scientific reports are disseminated for the exchange of information, it is essential that any cataloging for announcement should indicate where a copy of the document can be procured.

22 – In the US, any Department of Defense document issued after June 1972 must carry a statement from the person issuing the document as to the authority used for classifying the document.

23 – Date of Declassification. US Defense documents must carry a date or event upon which the document will become declassified, and this becomes part of the unit record.

24 – The translator, when named, is credited in a supplemental statement which also includes any journal or document from which the translation may have been extracted.

25 – Alpha or numeric computer code to represent the downgrading category the document has been assigned by the classifying authority.

26 – Numeric codes derived from distribution and availability statements.

27 – Corporate author numeric code. This number is used for computer entry to represent a corporate author selected from a corporate author authority list.

4.5 The foregoing list is not all-inclusive, of course. Any organization could add any element of information that will be useful to the organization's users, or delete any not applicable.

4.5.1 These data elements refer only to the descriptive portion of the cataloging process. Subject cataloging is covered in Volume 1, Section 3 – Abstracting and Subject Analysis.

4.5.2 Individual tagging of the smallest unit of data practicable is useful for the following purposes:

(a) "To select (or exclude) certain data elements at output time. For example, only author, title, and call number may be desired on an overdue notice, whereas author, title, call number and imprint may be desired on a new accessions list.

(b) "To order, arrange, or sequence the elements as desired in the particular product. Some abstracting and announcing services prefer title to be listed before author, whereas others prefer author before title. Also, there is much variety in abstracting and indexing services in the sequencing of the components of a journal article citation – volume number, issue number, page number, and date. Separate identification of each part allows for a variety of output arrangements.

(c) "To allow for various type fonts (boldface, italics, etc.) in automatic typesetting.

(d) "To prepare special indexes to the records (author, subject, etc.) or special arrangements of the records (by author, subject term, subject classification, language, date, etc.).

(e) "To subarrange identical filing entries by an element; e.g., subarranging an author's works by title.

(f) "To edit input data, e.g., performing validity checks on certain types of data or testing the presence or absence of a particular element in a record.

(g) "To isolate an element which may be subject to change after the original record has been created. Serial publications for example, are apt to change publishers, place published, numbering, frequency, etc. Separate identification of these elements and characteristics allows for changing the smallest amount of data, e.g., the place published rather than entire imprint statement.

4.5.3 "The reasons above pertain chiefly to creating various output products from machine records. The way data should be broken down and tagged in an on-line system so that they may be effectively worked upon, grouped and presented to the inquirer is a question which only experience with such systems can answer."[5]

4.6 Verbalizing for Machinability. Some useful guidelines are given in Appendix C which is an extract from the "Standard Operating Procedures" in use at the US Defense Documentation Center.

5. METHODS OF CATALOGING PRODUCTION

5.1 Conventional cataloging traditionally has been performed by typing the desired information on 3 x 5 cards, making the necessary number of copies and filing a copy under each of several headings in a dictionary catalog card file. An alternative is to subscribe to Library of Congress cards, or other such supplier of catalog cards, and to modify the information to meet the needs of the local library or Information Center. A modernized cooperative effort is the Ohio College Library Center (OCLC) System, an on-line cooperative cataloging system.

5.2 Although these methods have been effective for monographs, they do not lend themselves as well to technical report cataloging. Additionally, there are no suppliers of cards for such reports, other than those sometimes included in the report itself.

5.3 A card catalog can be created by the use of carbonized paper copies as the card is typed, marking a different copy (perhaps a different color) for each filing point desired.

5.4 The volume of work required and the space required for catalog card files are two problems that are forcing more and more organizations to use computer storage. Many find it practical to use a worksheet or coding sheet to record the information that is to be input, inasmuch as strict guidelines must be followed in providing information to a computer program. This should be done by trained personnel to insure retrieval, but the actual operation of the inputting machine can be accomplished by individuals of lesser training.

5.4.1 Any format of worksheet that suits the needs of the local organization will serve the purpose, provided it has designated spaces for each field which must be supplied with information. When there are space limitations for any field, these might be designated in the block for each field along with the type of information to be included. It would be helpful to the person coding the form and the machine operator if the coding sheet were arranged in the order the information is to be input.

6. ADMINISTRATION

6.1 Authority Files for Maintaining Cataloging Standards. Retrieval from a computer system requires that like information always be input in a like manner. This is easier to accomplish if files are established to standardize certain types of information which may be received with some variations. Cross-references can be made from the variations to the preferred form. The files can be maintained with or without computer storage. Of course, with computer storage, it is possible to update the file as needed and to get output publications or printouts as desired in a variety of formats.

6.1.1 The Corporate Author Authority File is essential, as reports may be received from many forms of an organizational name. To be able to collect these together, adequate references from variations of new and old names must be made. Corporate Author files are covered more extensively in Appendix A.

6.1.2 A Report Number Authority File enables the cataloger to determine by investigation the correct format for an organization's report number and to enter subsequent report numbers in the same format, even though there might be slight variations, especially in punctuation. Of particular importance is whether an acronym is to be used. In its simplest form, an alphabetical file of corporate authors should have a card for each one, indicating all the report number formats used by that organization. Another file of report numbers, arranged alphabetically by acronym or letters at the beginning of the report number, should identify any organization using that particular type of report number.

6.1.3 A Contract/Grant Authority File should contain a card for each such contract/grant when it is seen for the first time. At that time, a card should be typed indicating the contract/grant and the name of the organization to which it was assigned. After investigation of the correct format from the issuing agency, an authority card showing the form of the contract/grant to be used for computer entry should be typed. Only one card need be typed for a particular format, giving the accepted composite of alpha and numeric characters and punctuation. The issuing agency should be indicated on the format card. Once established, minor variations on documents can be spotted and, after proper investigation, corrected to conform to the accepted format.

6.1.4 A current file of Distribution Controlling Agency Addresses for use in granting release approval must be maintained if an organization expects to process many reports of a sensitive nature where special release precautions must be

taken. It will facilitate the referral of users to the appropriate office and provide for changes of address when the monitoring offices undergo reorganizations or other changes.

6.1.5 When a documentation center catalogs many papers from conferences, it might be helpful to establish a file for conference names so this information can be entered in the unit record of each report in the same way in order to facilitate retrieval of all papers from the conference.

6.1.6 An authority file of foreign periodicals might be valuable in establishing consistency. Translated articles may be received with a number of variations in names of periodicals and names of institutions furnishing the reports. If cross-references are made from the many variations to the preferred form, more complete, accurate and consistent citations should result.

6.2 Personnel Implications

6.2.1 The personnel required for a documentation center specializing in scientific and technical reports would depend on the amount of mechanization involved and the volume of work to be handled. An organization set up as a library using conventional methods would need at least one professional librarian and one experienced cataloger to train and oversee the number of clerk/typists and assistants necessary for the volume of work. With mechanization, it would be necessary to hire people trained in the use of automatic data processing equipment. For a full-scale large computer operation, there would be a need for systems analysts, computer programmers, computer operators, catalogers trained for the particular type of input needed, backup clerks for record-keeping, file maintenance, document and microfiche storage, machine repairmen, etc. Professional librarians and/or experienced documentalists are required to insure that standards are followed in input which will result in the retrieval capabilities and output products desired.

6.2.2 On-the-job training can be an excellent way to assemble a work-force trained in a particular mode of operation. It should be kept in mind, however, that training is only as good as the teacher and the course of study presented. If apt pupils, good teachers and a well-planned course of study are combined, previously untrained people can gradually be trained to perform many complex tasks adequately.

6.2.2.a In a cataloging operation, there is no substitute for an 'in house' manual of operating procedures. This reference should give complete instructions for every phase of the operation, and answer catalogers' questions on the data elements to be included in each cataloging field with specific limitations on space, punctuation, etc. Such a manual will be a valuable adjunct to other training materials as well as a ready reference for the experienced cataloger.

Appendix A

COSATI RULES FOR ESTABLISHING CORPORATE AUTHORS

GENERAL

Corporate author is the name usually given to the institutional or corporate body preparing the report, or editorially/contractually responsible for its content. The purpose of establishing a corporate author heading is to give the name of the corporate body in a way which is easy to identify and possible to retrieve from published indexes and other searching tools. The simplest corporate author heading consists of one organizational name and a geographic name. When more than two organizational names appear on the document, the corporate author heading includes only two; these two should be the largest and the smallest, and are written as – Largest, Place Name. Smallest.

Example: Harvard Univ., Cambridge, MA. Lab. for Computer Graphics and Spatial Analysis.

SPECIFIC GUIDELINES

A.1 US is omitted before government headings, but a subordinate element that begins with the words US, National or the state name in a state organization, is considered to be independent.

US Army Engineer District, Huntington
Corps of Engineers
Huntingon, WV.

Use: Army Engineer District, Huntington, WV.

US Department of Agriculture
Kentucky Agricultural Experiment Station
Lexington, KY.

Use: Kentucky Agricultural Experiment Station, Lexington.

A.2 Joint Committees are written directly under their own names.

Example: Joint Astrophysics Committee, London (England).

A.3 International organizations which have no permanent headquarters may be written with no place name.

A.4 The city or state name is not repeated in the address if it appears in the main heading.

Examples: Rochester Univ., NY
Polytechnic Inst. of New York, Brooklyn.
Pennsylvania Univ., Philadelphia.

A.5 The foreign country name is enclosed in parentheses, but is not repeated if it appears in any form in the main heading.

Examples: Paris Univ. (France). Dept. of Psychology.
Oesterreichisch; Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf.
Physics Inst.

A.6 The name University of . . . (city or state) is written beginning with the city or state name.

Examples: New Orleans Univ., LA
Pittsburgh Univ., PA
Pennsylvania Univ., Philadelphia.

A.6.1 University of . . . (geographic region) and State University of . . . are written as appearing without reversal.

Examples: University of Southern California, Los Angeles.
State Univ. of New York, Albany.

A.7 University departments are always written Dept. of . . . regardless of the way they appear on the report, but non-university departments are not changed.

Examples: Florida Univ., Gainesville. Dept. of Botany.
General Electric Co., Daytona Beach, FL.
Apollo Support Dept.

A.8 Abbreviations are not used as the first word of a corporate author heading.

A.9 If an organization uses an abbreviated form of its official name, the abbreviated form is preferred.

Examples: Army Materiel Development and Readiness Command, Texarkana, TX, Intern Training Center.
Committee on the Challenges of Modern Society (NATO), Brussels (Belgium).

Use: DARCOM Intern Training Center, Texarkana, TX.
NATO Committee on the Challenges of Modern Society, Brussels (Belgium).

A.10 If a corporate author changes its name, both old and new forms of the name are retained, and reports are cataloged under the name appearing on the document.

Example: Army Materiel Command, Alexandria, VA (prior to change)
Army Materiel Development and Readiness Command, Alexandria, VA. (new name)

A.11 When a report is authored jointly by two or more departments or components of the same organization, the heading should be no more specific than the smallest organizational level common to all components.

Example: Massachusetts Inst. of Tech., Cambridge. School of Engineering.
Department of Materials Science and Engineering. Research Lab. of Electronics.

Use: Massachusetts Inst. of Tech., Cambridge. School of Engineering.

A.12 If the first element of a heading begins with a personal forename, and is the name of a company or other commercial/industrial organization, the heading starts with the surname, followed by forename and/or initials enclosed in parentheses.

Example: Baldwin (D.H.) Co., Cincinnati, OH.

A.12.1 If the first element begins with a personal forename and is the name of a university, laboratory, institute, center, hospital, foundation or other apparently *noncommerical* organization, the heading is written directly as given.

Example: John B.Pierce Foundation, Raritan, NJ.

A.12.2 In a subordinate element, personal names are not rearranged.

Example: Pennsylvania Univ., Philadelphia. John Harrison Lab. of Chemistry.

A.13 A subordinate element of a government agency that has a report series is written separately.

Example: Mathematics and Computation Lab. (FPA), McLean, VA. GSA/FPA/*MCL*-TM-225.

A.14 Parenthetical identification is added when necessary.

Example: Deputy Chief of Staff for Logistics (Army), Washington, DC.

A.15 If an independent element of a government agency is an Institute, Laboratory or Center, no further subdivision is made unless the subordinate element is also represented by a report series.

Examples: Oak Ridge National Lab., TN.
National Environmental Satellite Center, Washington, DC.

A.16 Foreign names are written in the native language, or transliterated from the native language whenever the native form is known; but if the foreign institution chooses to publish all its reports under an English form of corporate name, use the English form.

A.17 Foreign universities are written in the same way as American universities. If the name of the university begins with the foreign equivalent of University of . . . (place name), write the place name first, followed by Univ.

Examples: Paris Univ. (France)
Brazil Univ., Rio de Janeiro

A.17.1 If the university name refers to a geographical region, write it as it appears.

Examples: University of Western Ontario, London.
University of the West Indies, Kingston (Jamaica).

A.18 In Canadian headings, the name of the province is used in parentheses instead of the country name, but a city name the same as the province is not repeated.

Examples: Montreal Univ. (Quebec)
Laval Univ., Quebec.

A.19 Abbreviations.

A.19.1 If any of the following terms is written out on the document, it should be abbreviated in the corporate heading, except when appearing as the first word:

Abteilung	Abt.
Air Force Base	AFB
Air Force Station	AFS
Aktiebolaget	A.B.
Aktiengesellschaft	A.G.
Aktieselskab, Aksjeselskap	A.S.
Brothers	Bros.
College	Coll.
Compagnie	Cie
Company	Co.
Corporation	Corp.
Departamento	Dept.
Departement	Dept.
Departementet	Dept.
Department	Dept.
Divisao	Div.
Division	Div.
Divisione	Div.
eingetragener Verein	e.V.
Etablissement	Ets.
Gebroeders, Gebrueder	Gebr.
Gesellschaft mit beschraenkter Haftung	G.m.b.H.
Incorporated	Inc.
Ingenieur	Ing.
Institut	Inst.
Institute	Inst.
Institute of Technology	Inst. of Tech.
Institutet	Inst.
Instituto	Inst.
Institutt	Inst.
Institutul	Inst.
Instituut	Inst.
Instytut	Inst.
Istituto	Ist.
Kabushiki Kaishi	K.K.
Laboratoire	Lab.
Laboratoires	Labs.
Laboratories	Labs.
Laboratoriet	Lab.
Laboratorio	Lab.
Laboratorium	Lab.
Laboratory	Lab.
Limited	Ltd.
Maatschappij	Mij.
Manufacturer	Mfr.
Manufacturing	Mfg.
Naamloze Vennootschap	N.V.
Sociedad Anonima, Societe Anonyme	S.A.
Societa per Azioni	S.p.A.
Societe a Responsabilite Limitee	S.R.L.
Universidad	Univ.
Universidade	Univ.
Universita	Univ.
Universitaet	Univ.
Universitas	Univ.
Universitatea	Univ.
Universite	Univ.
Universiteit	Univ.
Universitet	Univ.
Universitetet	Univ.
Universiti	Univ.
University	Univ.

Univerzita	Univ.
Univerzitet	Univ.
Uniwersytet	Univ.
Volkseigene Betrieb	VEB

Note: This rule does not restrict the use of abbreviations that occur on the document.

A.19.2 The following abbreviations for state names are used when appearing as the location element in the corporate heading.

Alabama	AL	Montana	MT
Alaska	AK	Nebraska	NE
Arizona	AZ	Nevada	NV
Arkansas	AR	New Hampshire	NH
California	CA	New Jersey	NJ
Colorado	CO	New Mexico	NM
Connecticut	CT	New York	NY
Delaware	DE	North Carolina	NC
District of Columbia	DC	North Dakota	ND
Florida	FL	Ohio	OH
Georgia	GA	Oklahoma	OK
Hawaii	HI	Oregon	OR
Idaho	ID	Pennsylvania	PA
Illinois	IL	Rhode Island	RI
Indiana	IN	South Carolina	SC
Iowa	IA	South Dakota	SD
Kansas	KS	Tennessee	TN
Kentucky	KY	Texas	TX
Louisiana	LA	Utah	UT
Maine	ME	Vermont	VT
Maryland	MD	Virginia	VA
Massachusetts	MA	Washington	WA
Michigan	MI	West Virginia	WV
Minnesota	MN	Wisconsin	WI
Mississippi	MS	Wyoming	WY
Missouri	MO		

A.20 Place Names.

A.20.1 The National Zip Code Directory is used to establish the correct form of the place name in cases of doubt. If a branch post office has a ZIP code different from that of the post office, use the name of the branch post office.

Example: Boston, MA., has many branch post offices with their own zip codes which use their own city names – Cambridge, Kendall Square, Lexington, Newton, Quincy, Waltham, etc.

A.20.2 For military installations, use the post office as given in the Directory. For FPO's and APO's, follow the military form for the location element.

Examples: Griffiss AFB, NY.
APO New York 09108
FPO San Francisco 96318

A.20.3 Foreign place names are written in the form of common usage as indicated by the Board on Geographic Names; however, when the name forms an integral part of the heading, retain the native form.

Turin Univ. (Italy).

but: Politechnico di Milano (Italy).

A.21 Establishment and maintenance of a Corporate Author Authority File.

A.21.1 When a system or standard has been agreed upon for the establishment of corporate authors and a code to represent those authors in a machine system, each corporate author with its corresponding number should be typed on a 3 x 5 card with any cross-references deemed necessary. One card should be filed with the codes in numeric sequence, and another in an alphabetical file, which also contains the see-references.

Example:

409 359

Rensselaer Polytechnic Inst., Troy, NY.
Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics.
xx Rensselaer Polytechnic Inst., Troy, NY.
Dept. of Aeronuatical Engineering and Astronautics.
xx Rensselaer Polytechnic Inst., Troy, NY.
Dept. of Mechanical Engineering.

A.21.2 COSATI Forms of Cross-References.[4]

A.21.2.a A change in the name of a corporate author is covered by an *sa* (*see also*) reference which refers the user to the later names. The *xx* (refer also from) reference indicates the previous names.

Clinton Labs., Oak Ridge, TN.
sa Clinton National Lab., Oak Ridge, TN. (later name)
sa Oak Ridge National Lab., TN. (later name)

Clinton National Lab., Oak Ridge, TN.
sa Oak Ridge National Lab., TN. (later name)
xx Clinton Labs., Oak Ridge, TN. (former name)

Oak Ridge National Lab., TN.
xx Clinton Labs., Oak Ridge, TN. (former name)
xx Clinton National Lab., Oak Ridge, TN. (former name)

A.21.2.b If the smaller part of the organizational name might appear on some other report without full identification, make a cross-reference from the name of the smaller part.

Committee on Foods (NAS-NRC), Washington, DC. *See* National Academy of Sciences-National Research Council, Washington, DC. Committee on Foods.

Institut fuer Theoretische Physik, Graz (Austria). *See* Graz Univ. (Austria). Institut fuer Theoretische Physik.

Laboratoire de Chimie Physique, Paris (France). *See* Paris Univ. (France). Laboratoire de Chimie Physique.

A.21.2.c Make a *see* reference from alternate forms of the name.

Danmarks Tekniske Hoejskole, Lyngby. *See* Technical Univ. of Denmark, Lyngby.

A.21.2.d Make cross-references to show organizational elements that have been omitted in the heading.

Office of Naval Research, Washington, DC. Naval Research Lab. *See* Naval Research Lab., Washington, DC.

California Univ., Berkeley. Dept. of Physics. Cosmic Ray Group. *See* California Univ., Berkeley. Cosmic Ray Group.

Air Force Systems Command, Wright-Patterson AFB, OH. AF Aero Propulsion Lab. *See* Air Force Aero Propulsion Lab., Wright-Patterson AFB, OH.

Research and Technology Div., Wright-Patterson AFB, OH. AF Aero Propulsion Lab., *See* Air Force Aero Propulsion Lab., Wright-Patterson AFB, OH.

A.21.2.e Make cross-references from acronyms and abbreviations.

AEC. *See* Atomic Energy Commission, Washington, DC.

A.21.2.f When establishing a heading for a foreign corporate body, a cross-reference from the name of the foreign country may be included.

Instituto Venezolano de Investigaciones Cientificas, Caracas. x Venezuela.
Instituto Venezolano de Investigaciones Cientificas, Caracas.

Appendix B

HANDLING AND CONTROL OF CLASSIFIED DOCUMENTS AND MATERIALS

B.1 National security must be safeguarded by adequate control of classified materials, but these controls need not be elaborate. The system described below has proved adequate over a number of years of operation at the Defense Documentation Center (DDC) in the USA.

B.2 Classified materials are kept in a secure area which requires an official identification badge for entrance. Additionally, documents are locked in cabinets or heavy metal cages when unattended, and keys are safeguarded.

B.3 The incoming mail room receives classified materials in a sealed bag from the Post Office. The mail room signs two receipts for the Post Office, one for the seal and one for certified and registered mail numbers, checking to be sure all numbers are accounted for. Classification markings have been stamped on the materials by the originators. The mail room transfers routine documents for accession to the proper office and logs out to the proper individuals any non-routine material. Receipts are returned to the sender of the classified material. NATO documents require additional control; a receipt traveling with the document must be signed by all individuals handling the documents.

B.4 Throughout processing, logs are kept as the documents travel from office to office and the documents are safeguarded in locked containers when unattended. If a change in classification is received before processing is completed, the documents are returned to the mail room for correction of records. When processing is completed, the documents are photographed and stored in a locked area with the microfim in another locked area. Anyone with a need to see either must sign a log, thereby becoming accountable for the material until returned.

B.5 Requests for copies of documents are handled by the storage, printing and shipping sections, following guidelines for control and handling of classified material. Shipping room receives computer orders, mailing labels and cards from reference section, which has approved the requests. Shelf stock is pulled when available, or film for duplicating. Documents are wrapped for mailing, and markings of CNWDI* and NATO** stamped on the inner envelope as required. A postal registry number is entered on Secret, CNWDI and NATO documents. Two copies of a receipt form (67 or 67A) are sent with the document. The remaining two copies are sent to the Central Command Register. The address label to be affixed to the inner package is stamped with the highest classification of any document in the package. The address label which is to be affixed to the outer wrapping is stamped with the word "Registered" or "Certified", and the registry number for the package entered. Packages containing only Confidential documents are mailed by certified mail. A Post Office Department Form 3877, Application for Registration or Certification, is completed in quadruplicate, and the registry or certified number checked. The number of documents in the package is counted, and entered on copy No.4 of the postal form as a record for tracer actions, if necessary. Package is then wrapped with highest classification stamped top and bottom, front and back. A NATO access notice is inserted between wrappings when applicable. Package is then wrapped with outer wrapping, and the address label affixed with registry number. Nylon tape is affixed both lengthwise and crosswise on large packages. Prior to delivery of packages to post office, a rotary lock is attached to the mail pouch, with the rotary lock number on all copies of Form 3877. First and second copies of the form go into the pouch before closing and locking. The third copy goes in a suspense file. Three copies of Post Office Form 3853, Registry Dispatch Book, are prepared. A Post Office employee signs and returns one copy of Form 3853 and takes the mail pouch and two copies. Upon receipt from the Post Office Department of the original Form 3877, the original is filed and the suspense copy destroyed. Follow-up is initiated in 15 days for signed receipts for Secret documents shipped, if receipt has not been received. Additional follow-up is made at 30 and 45 days. If a signed receipt is not received after 45 days, a special letter written by the DDC Secret Control Officer is initiated and/or tracer action will be requested from the Post Office. All actions are documented and turned over to the Security Support Branch. When a signed receipt is received in normal time, the signed Form 67 or 67A is filed and the suspense copy destroyed.

B.6 After processing is completed, any change in the classification of a document is made by a file maintenance program.

B.6.1 An automatic list which is run four times a year lists all documents on file that have become eligible for downgrading or declassification. Catalog cards and computer files are corrected. Notice is sent to microfilm library, storage, camera unit, and outside units holding reports to make the necessary changes.

B.6.2 Individual changes are made whenever notice is received from the original classifier or sponsor by letter. Film lab, storage and camera unit are given an advance listing of these changes, and outside units receive the reclassification notices.

B.6.3 Declassified documents still require a release before they can be changed to unlimited distribution.

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* Critical Nuclear Weapon Design Information

** North Atlantic Treaty Organization

Appendix C

VERBALIZING FOR MACHINABILITY*

The following symbols may be used in abstracts, annotations, and titles:

. , : ; ' / * $ % ( ) - + = < >

l l l l u l u u u u u u l u l u u = upper and lower case for character count

ANGSTROM UNITS ($\mathring{A}$)
Use A

CHEMICALS
H_2SO_4 *use* H2SO4

→ *use* yields

CUBIC
cm^3 *use* cu cm *or* cc

ft^3 *use* cu ft

m^3 *use* cu m

DEGREES
32° *use* 32 deg

32° F *use* 32 F

32° 16' 8" *use* 32 deg 16 min 8 sec

EXPONENTS
$x^{(n-1)}$ *use* x to the (n-1) power

$ft\ sec^{-1}$ *use* ft/sec

When the exponent is less than 7 and has the base 10, write out the number; e.g.,

10^2 *use* 100

10^{-4} *use* 0.0001

2.75×10^{-3} *use* 0.00275

When the base is 10 and the exponent is 7 or more, write out; e.g.,

10^7 *use* 10 to the 7th power

10^{-9} *use* 10 to the minus 9th power

See also CUBIC, SQUARE, SUPERSCRIPTS

FRACTIONS
Use the slash (virgule) for the fraction bar; e.g.,

$x = \frac{a-b}{c}$ *use* x = (a-b)/c or spell out equals

$x = a - \frac{b}{c}$ *use* x = a-(b/c) or spell out equals

GREATER THAN OR EQUAL TO ($\geq$)
Use > or = or spell out

GREEK LETTERS
Use their names; e.g.,
α *use* alpha
β *use* beta
π *use* pi

ITALICS
Do not use; see also UNDERSCORING

LESS THAN OR EQUAL TO ($\leq$)
Use < or = or spell out

LOGARITHMS
$\log_{10}$ *use* log

$\log_e$ *use* ln

MATHEMATICAL SYMBOLS
See SPECIAL SYMBOLS

MICRO- and MICROMICRO-
μv *use* microvolts

$\mu\mu f$ *use* micromicrofarads *or* picofarads

MICRONS
μ *use* micron
$m\mu$ *use* millimicron
μm *use* micrometers
$\mu\mu$ micromicron

PLUS OR MINUS ($\pm$)
Use + or − or spell out

QUESTION MARK (?)
Do not use; rephrase sentence

QUOTATION MARKS (")
Use the apostrophe or single quote only; e.g., The term 'overkill'
Where quotation marks are conventionally used as a symbol, abbreviate; e.g.,
12" *use* 12 in
45" *use* 45 sec

See also DEGREES

*Standard Operating Procedures; DSA, Defense Documentation Center, Alexandria, Va.

VERBALIZING FOR MACHINABILITY*

SPECIAL SYMBOLS

$\simeq$ } *use* approximately
$\approx$ }

$\rightarrow$ { *use* yields *(chemistry)*
use approaches limit of *(mathematics)*

\# *use* no.

& *use* and *in titles, abstracts, and annotations*

∞ *use* infinity

λ { *use* wavelength *(electronics and physics)*
use lambda *(all other)*

Ω { *use* ohms *(electricity and electronics)*
use omega (all other)

ϕ { *use* phase *(electricity and electronics)*
use phi *(all other)*

Similarly, spell out or show by acceptable alphanumeric characters increment, varies as, therefore, differential of, variation of, integral, sum, benzene ring, thunderstorm, male, female, fixed star, *etc.*

SQUARE

cm^2 *use* sq cm

ft^2 *use* sq ft

m^2 *use* sq m

SQUARE ROOT

$\sqrt{a-b}$ } *use* square root of (a-b)
$(a-b)^{1/2}$ }

SUBSCRIPTS

V_1 *use V sub 1*

B_5 *use* B *(omit the 5, which is the atomic number of boron)*

See also CHEMICALS

SUPERSCRIPTS

H^+ *use* H(+)

SO_4^{--} *use* SO4(--)

V^{5+} *use* V(5+)

U^{234} *use* U234

B^{10} *use* B10

$O^{18}(p,n)N^{15}$ *use* O18(p,n)N15

d_{23}^{25} *use* density at 23 deg F referred to water at 25 deg F

n_D^{20} *use* index of refraction for 20 deg F and sodium light

See also CUBIC, EXPONENTS, SQUARE

UNDERSCORING

Do not use underscoring

Escherichia coli *use* Escherichia coli

to set off special terms use single quotes;
e.g.,

the term quasar *use* the term 'quasar'

*Standard Operating Procedures; DSA, Defense Documentation Center, Alexandria, Va.

TRANSLITERATION OF FOREIGN ALPHABETS

GREEK

Α α	alpha	a	(ä)
Β β	beta	b	(b)
Γ γ	gamma	g	(g)
Δ δ	delta	d	(d)
Ε ε	epsilon	e	(ĕ)
Ζ ζ	zeta	z	(z)
Η η	eta	ē	(ā)
Θ θ	theta	th	(th)[7]
Ι ι	iota	i	(ĭ)
Κ κ	kappa	k	(k)
Λ λ	lambda	l	(l)
Μ μ	mu	m	(m)
Ν ν	nu	n	(n)
Ξ ξ	xi	x	(ks)
Ο ο	omicron	o	(ŏ)
Π π	pi	p	(p)
Ρ ρ	rho	r, rh	(r)
Σ σ ς	sigma	s	(s)
Τ τ	tau	t	(t)
Υ υ	upsilon	y, u	(ü, o͞o)
Φ φ	phi	ph	(f)[8]
Χ χ	chi	ch	(k, ĸ)[9]
Ψ ψ	psi	ps	(ps)
Ω ω	omega	ō	(ŏ)

RUSSIAN

А а	a		(ä)
Б б	b		(b, p)
В в	v		(v, f)
Г г	g		(g, k)
Д д	d		(d)
Е е	e		(yă, ă, yŏ, yŏ, yĕ, ĕ)
Ж ж	zh		(zh, sh)
З з	z		(z)
И и Й й	i, ĭ		(ē, y)
І і[10]	i		(ē)
К к	k		(k)
Л л	l		(l)
М м	m		(m)
Н н	n		(n)
О о	o		(ŏ, ŏ)
П п	p		(p)
Р р	r		(r)
С с	s		(s)
Т т	t		(t)
У у	u		(o͞o)
Ф ф	f		(f)
Х х	kh		(ĸ)
Ц ц	ts		(ts)
Ч ч	ch		(ch, tsh)
Ш ш	sh		(sh)
Щ щ	shch		(shch)
Ъ ъ[10]	*		—
Ы ы	y		(wĕ, ŭĕ, ĭ)
Ь ь	e, —, ’†		(ĕ, —)
Ѣ ѣ[10]	ye		(yĕ, ĕ)
Э э[10]	e		(ĕ)
Ю ю	yu		(yo͞o [ŭ])
Я я	ya		(yă, yā, ē)
Ѳ ѳ[10]	f		(f)
Ѵ ѵ[10]	y		(ē)

* marks nonpalatalization
† marks palatalization

GERMAN

𝔄 𝔞		(ä)
𝔅 𝔟		(ă, ĕ)
𝔅 𝔟		(b, p)
𝔈 𝔠		(k, ts, s)
𝔈𝔥 𝔡𝔥		(ĸ)
𝔇 𝔡		(d, t)
𝔈 𝔢		(ă, ĕ)
𝔉 𝔣		(f)
𝔊 𝔤		(g, ĸ, k)
𝔓 𝔥		(ă)
𝔍 𝔦		(ĕ, ĭ)
𝔍 𝔧		(y)
𝔎 𝔨		(k)
𝔏 𝔩		(l)
𝔐 𝔪		(m)
𝔑 𝔫		(n)
𝔒 𝔬		(ŏ, ō, ŏ)
𝔒̈ 𝔬̈		(ŭ)
𝔓 𝔭		(p)
𝔔 𝔮 (k)		Only in qu pron. kv
𝔑 𝔯		(r)
𝔖 𝔰 ſ		(z, s)
𝔖𝔥 ſ𝔥		(sh)
𝔗 𝔱		(t)
𝔘 𝔲		(o͞o, o͝o)
𝔘̈ 𝔲̈		(ü)
𝔙 𝔳		(f, v)
𝔚 𝔴		(v)
𝔛 𝔵		(ks)
𝔜 𝔶		(ĕ, ĭ, ü)
𝔷 𝔷		(ts)

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Section 3

ABSTRACTING AND SUBJECT ANALYSIS

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ABSTRACT

This Section provides an overview of the processes of abstracting and subject analysis (indexing) for defence/aerospace documentation centers and specialised defence establishments. The focus is on a practical, rather than theoretical, approach for both the senior person setting up a new system and for the more junior person interested in training assistance. The section summarizes and provides an overview of practical aspects of the two areas, with references to authoritative texts. The major areas covered include: abstracting, subject analysis, thesaurus development, and the use of computers in abstracting and indexing. Sections on definitions and scope, examples of types of indexing and abstracting, references to relevant standards, and a summary of techniques are included.

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1. INTRODUCTION

1.1 This Section of the Manual provides an overview of the processes of abstracting and subject analysis for defence-aerospace information centers. No single Section in a manual such as this could possibly provide comprehensive training in the complex fields of abstracting and subject analysis. Some on-the-job experience and apprenticeship has been assumed as a background for this Section. Information on abstracting and subject analysis at the analytic level of chapters within books and articles within journals, rather than book and journal literature at the collective level, is included.

1.2 This Section is intended to be used by both senior and junior staff in information centers working on the processing of unpublished reports and other documents, such as reprints of journal articles and other non-monographic material, and by individuals involved in the hiring, training, and supervision of abstractors and indexers. It is designed to be used by persons with some experience in abstracting and indexing as a summary overview and as a "refresher course" on the topic. The authoritative texts cited should be consulted for more detailed information.

1.3 The Section is divided into four major segments: abstracting, subject analysis, thesaurus development, and the use of computers in abstracting and indexing. The terms subject analysis and indexing are used interchangeably throughout the text. The first two segments include a section on definition and scope, a discussion of types of each, references to relevant standards, and a summary of technique. The third segment focuses on thesaurus development and includes a definition of a classical thesaurus in contrast to a list of subject headings, and a discussion of the problems of thesaurus maintenance. In the fourth part, the experimental use of computers in abstracting is considered briefly. A more detailed discussion of the use of computers to aid in indexing and to produce indexes, is included.

2. ABSTRACTING

2.1 Definition and Scope

2.1.1 The Definition of Abstracts and the Need for Abstracts

The growth of the scientific and technical literature over the past several years has continued to increase significantly. In a recent United States study funded by the US National Science Foundation and conducted by King Research Inc.[1] it was found that between 1960 and 1974 the number of scientific periodicals published worldwide increased from 18,800 to 49,400, a 163% increase. In order to sift through the voluminous quantity of literature to identify those documents of interest to him, the researcher often relies on abstracting and indexing (A&I) services, which provide subject access to the literature through indexing and which provide summaries of the literature covered by presenting abstracts of each document covered. Abstracts are usually consulted to determine the need for reading the complete document. Also, they may be read for background information on a topic.

An abstract is a summary of a larger work. As Ben H.Weil and his colleagues have noted, throughout many definitions of abstract and its synonyms, there is a constant thread of " 'fewer words, yet retaining the sense'; 'condensation and omission of more or less of detail, but retaining the general sense of the original'; and . . . . "a brief or curtailed statement of the *contents* of a topic or a work' and a *part* which represents typically a large and intricate whole.' "[2] [author's emphasis].

2.1.2 Use of Abstracts

There are numerous uses of abstracts; among these are nine uses enumerated by Charles L.Bernier[3]. These uses are: (1) translation into languages other than that in which the original document was written; (2) facilitating selection of documents; (3) a substitute for the original document; (4) time-saving; (5) more convenient and less expensive organization of documents into related groups than can be done with the original documents; (6) retrospective searching; (7) more accurate selection of literature to be read or translated than through titles alone or titles plus annotations; (8) facilitating indexing by concentrating the indexable subjects to speed indexing and by eliminating the language problem; (9) facilitating the preparation, acquisition, and searching of documents through ease of physically organizing (e.g., copying, cutting and pasting) abstracts. Additional uses include current awareness services, such as *CA Selects* published by the American Chemical Society, in which abstracts of documents on selected topics are indexed and listed with bibliographic reference in publications issued at frequent, often weekly, intervals.

Several of these uses of abstracts are particularly relevant to specialized information centers. The defence/aerospace literature is published in many different languages. Having abstracts in the single language, or perhaps the two primary languages, of the users of the center simplifies the selection of documents pertinent to the individual user's needs and saves the user considerable time. Including abstracts in a current awareness service increases the quantity and quality of information available about each document and aids the user in his selection.

For the internal processing of documents, abstracts save the information specialists time in indexing the document and may improve the quality of the indexing through translations when necessary and by providing a consistent approach to the documents in the collection. With the important keywords contained in the document grouped into the abstract

and translated into a single language, the indexer is presented with a consistent and easily readable summary from which to index, referring to the complete document when necessary.

2.2 Types of Abstracts

2.2.1 Definition of Types of Abstracts

Types of abstracts are generally defined in terms of the purposes of the abstract, although Borko and Bernier[4] also categorize them by whom they were written and by form. The three most common types of abstracts are informative (or descriptive) and an annotation. These have been defined by Weil et al. as follows:

> The 'informative,' 'informational,' or 'comprehensive' abstract, one that is still complete enough in its distillation 'to communicate knowledge.' This type of abstract contains the significant findings, arguments, and applications; states the scope; and usually at least indicates such other important aspects of the document as methods and equipment used . . . .
>
> The 'indicative' or 'descriptive' abstract usually restricted to descriptive statements about the contents of the document . . . .
>
> The 'annotation,' in which a few words or a sentence are added to a title by way of further description, explanation, or even critical comment. Annotations are usually indicative, it is difficult to make them informative . . . .[5]

Two additional types of abstracts defined in terms of purpose are "title-only" abstract and the "slanted" abstract. These are defined as follows:

> The 'title-only' abstract, where the title of a document is used without amplification to describe the document's contents. Titles usually state subjects, not findings, so are usually indicative rather than informative.
>
> The 'slanted' abstract, in which the information or description reported is oriented to a specific 'discipline' or to an industrial or governmental field or 'mission.' In such abstracts, emphasis may sometimes be placed on methods, equipment, or findings that were only incidental to the author's major purpose; the latter may even be omitted or minimized.[6]

In all of these definitions it is implied that a bibliographic description adequate to identify the original documents is provided with the abstract. The bibliographic description is part of the cataloguing of a document, rather than abstracting or subject analysis, and is discussed in Section 2 of this Manual.

Borko and Bernier also describe two types of abstracts in terms of their form – telegraphic and statistical (or tabular) abstracts[7]. Telegraphic abstracts are "abstracts written in a highly regularized form . . . [which] have been tried primarily for facilitating computer search through the abstracts themselves. Although one purpose was brevity, the main objective was to prepare the abstract for computerized searching while still maintaining human intelligibility". The American Society of Metals experimented with the use of telegraphic abstracts but replaced them with standard abstracts when tests showed some difficulty in their use.

The statistical or tabular abstract "is used for certain specialized subjects, such as thermophysical properties, where the emphasis is exclusively on the data"[8]. This type of abstract, which is used by *Statistical Abstracts of the United States*, may be useful for some documents in the aerospace and defence area.

2.2.2 Selection of Type of Abstract

The reader is referred to the excellent series of papers by Weil et al. in the *Journal of Chemical Documentation*[9] for a clear and succinct discussion of the complexities involved in technical abstracting. The authors emphasize several important points, which are of direct relevance to abstractors in information centers. Ideally any abstract should serve four purposes:

1. Inform interested people about the forthcoming paper, if it is to be presented at a meeting.
2. Enable readers to determine whether they must read all or part of the full document to obtain needed or valuable information.
3. Be suitable for direct re-use in secondary journals and in retrieval systems.
4. At least serve as a basis for rewriting or editing for these latter and other uses.

The first purpose may not be essential to an information center, but the other three clearly are necessary. Any single abstract should provide a screening device for the reader or intermediary to determine whether the entire document should be read, should be suitable for use in the center's retrieval system (whether a manual or a machine system), and should at least serve as a basis for use in the retrieval system and, preferably, without rewriting for use by indexers in the center. Thus, the type of abstract to be selected must serve many purposes for the information center, for both internal use by the staff and external use by researchers.

An information center must define both the potential uses of its abstracts and the traits of the users of the abstracts in order to determine which type of abstract (or which types) to select. A third important factor is that of cost. For

example, financial constraints may preclude the writing of original abstracts and require that the abstracts provided in the original documents be used with only essential rewriting done. If the abstracts are to be used for external purposes (i.e., by scientists and engineers searching the literature), the abstract should not only transmit information quickly and clearly to the interested user, but also must warn the uninterested person not to bother reading further. This screening function of abstracts is one of the most important ones for the user.

For a variety of reasons described by Weil et al.[10] and by Borko and Bernier, informative abstracts may well be the most desirable type of abstract for the many uses discussed above. Informative abstracts transmit salient facts from the document rather than simply indicating that certain information exists in the document. Some types of documents do not lend themselves well to informative abstracts, and abstracts which are more descriptive than informative may be required. For example, review articles, documents that contain extensive mathematical formulas, or documents covering many different subjects may best be summarized by a brief indicative abstract.

There are three variations of the informative abstract: (1) the "conventional", or "bibliographical-data-first", (which Weil et al. refer to as the "mystery-story" abstract); the "findings oriented", or "topical-sentence-first", (dubbed "reader-oriented" by Weil et al.); and the "title-first" variation of the "reader-oriented" informative abstract[11]. In the first variation, the "mystery-story" abstract, the title of the document and other bibliographic information precede the text of the abstract. This is the most common arrangement in abstracting and indexing services.

In the "reader-oriented" abstract the text of the abstract precedes the bibliographical material. Also, the important findings, conclusions, etc. are presented quickly, and any new or novel material appears in the topical sentence.

The "title-first" variation begins with the document's title followed by a findings-oriented topical sentence. As Weil et al. point out, "Title-first abstracts are probably acceptable alternates to those beginning with a full-fledged topical sentence: (a) for use on a reader-altering page that is intended to be an expanded table of contents, (b) if abstracters deliberately wish to place stress on scope, or (c) if the abstracters or publishers do not want to assume the responsibility for selecting the main findings"[12]. The authors argue strongly that the bibliographic citation should be placed after the body of the abstract to aid the user.

2.2.3 Automatic Abstracting

Research on automatic abstracting by computers began in the early 1950's. The rapid growth of the literature and the increasing cost of preparing abstracts are the primary motivations for this research. Borko and Bernier provide an overview of research on this area[13]. Automatic abstracting remains at the research stage, and the majority of abstracting is still done by people rather than machines.

2.3 Writing Abstracts

2.3.1 Form and Style of Abstracts

In addition to the bibliographic description and the body of the abstract, usually subject terms appear with an abstract. The area of subject analysis will be discussed in part 3 of this publication. The bibliographic description is covered in a separate publication – Section 2 of the Manual of Documentation Practices.

In a reader-oriented abstract, the first sentence should be a topical sentence containing the most important findings, conclusions, and recommendations of the document. "The new material should be at the start of the sentence, prominently displayed (in bold-faced type, capitals, or underlined) to aid in rapid scanning. Such a topical sentence is essentially a one-sentence abstract of the abstract, and should be so considered. If it is properly prepared, it will contain most of the key descriptors needed for indexing[14]. Thus, the abstract will provide the reader with the essence of the document quickly and succinctly and, in addition, will provide many keywords for use in indexing. Both internal and external needs can be filled by a single abstract.

Brevity is essential in good abstract writing. The topical sentence should be as short as possible. Important details that are not part of what is novel about the document should not be included in the topical sentence; these qualifying or limiting details should be presented in sentences after the topical sentence. The beginning of the topical sentence should immediately identify what is unique about the document and should state concisely what differentiates the document from other documents. It is perfectly acceptable to incorporate some or all of the document's title in the topical sentence if the sentence does not immediately follow the title in the abstract.

Weil and his colleagues caution against the use of stock phrases at the beginning of each topical sentence, especially when groups of abstracts on related subject areas are to be published or filed together. Because the collections of most specialized information centers are concentrated within specific subject areas, the use of stock phrases should be avoided or a great number of abstracts will have very similar topical sentences. This would impede rapid delivery of the unique information contained within documents and may be less than attention-getting for users.

Direct statements in the active voice are preferred to indirect statements in the passive voice, because they are briefer and clearer. Of course, the syntax needed to put important facts first sometimes requires the use of the passive voice for subject emphasis.

Most abstracts require a few general, indicative sentences to describe the document. After the topical sentence, a few indicative sentences may be needed to complete the description of the important points of the document.

2.3.2 Content of Abstracts

In a technical information center, abstracts are prepared for a wide range of documents that contain types of information. In addition, as discussed above, the abstracts must be written for a variety of users, including information scientists, other scientists and engineers, and perhaps even the layman. Most technical documents report a new piece of human knowledge obtained by observing and/or analyzing data.

Abstracts of this type of technical document should contain the study's purpose, findings, conclusions, and recommendations; the primary experimental results; and essential elements of the methodology used. Introductory and background material are usually omitted unless the document is considered to be outside the field of expertise of the intended users of the abstract. The abstract should include methodological details only if they are new; in which case the abstract should include "the basic principle, range of operation, and degree of accuracy"[15]. Detailed results of an experiment are not usually included unless the abstract is actually intended to serve instead of the complete document.

"Abstracts of proposals, or descriptions of new programs or industrial processes, should include the purpose, the method or steps in the program or process, the advantages in comparison with other such programs or processes, the disadvantages, and the costs"[16]. Specific needs of the user audience may require other details in the abstract. For example, orientation by date or geographic location may be helpful to certain users, while design details or physical properties may be more important to other users. In summary, essential elements for most abstracts of technical documents include the purpose, findings, conclusions, and recommendations; the primary experimental results; and essential elements of the methodology used. Other elements to be included depend on the nature of the user audience and the multiple uses of the abstract.

2.3.3 Techniques for Writing Abstracts

Several techniques have been described above for writing abstracts. Each abstracting service has its own method of training abstractors, and there are many different ideas on the best order in which to perform the necessary steps of preparing an abstract. One sequence of steps for identifying the key information in a document to include in an abstract is that used by Exxon Research and Engineering Company. It is described in the *Journal of Chemical Documentation* as follows:

1. Read the introduction first if you are unfamiliar with the subject.
2. Read the author's abstract if one is included. Use it as far as possible if a further check of the document proves it to be a good one.
3. Review the summary and conclusions of the paper.
4. Scan the text for additional information, examining the captions of tables and figures.
5. Jot down marginal notes as you go along, and underline salient phrases and passages.
6. Then, and then only, write the topical sentence and the rest of the abstract (what was found, and where pertinent, why and how the work was done), plus the bibliographical citation.

Authors of documents who write their abstracts after they have written the full texts may very well benefit by following points in the above procedure." Lack of a definite method of checking what he has written causes many a writer to leave important facts out of his own abstract"[17]. Whatever procedure is used, it is essential that the procedure be clearly defined and followed by all abstractors. A procedures manual should be developed for use by the abstractors.

Ideas on the optimum length of abstracts range from 100–600 words. "The desirable length for a given abstract is usually a function of the type of document involved, the availability of the document, the ability of the average reader to read the language of the original document, and available funds. It is important to remember, however, that readers often react unfavorably to unduly lengthy abstracts, so brevity has a value that transcends economics"[18].

Articles dealing essentially with a single topic can usually be abstracted in a reader-oriented abstract of 125–150 words. However, abstracts of internal reports may require 500–600 words. UNESCO's Guide[19] recommends a limit of 200 words except for extraordinary cases in order to permit the printed abstract to be mounted on a 3 x 5 inch card.

As discussed certain documents (e.g., review articles, news items, and documents containing extensive mathematics) may require indicative abstracts, rather than informative abstracts. If the document will not be readily available to users or if the document is in a language which the users are not likely to understand, a longer abstract containing more details may be required. Such abstracts may be written in two parts with the first consisting of a reader-oriented abstract, and the second providing more details. The second part may contain a clearly identified introduction for readers not familiar with the subject area or unable to read the original document.

Weil, Zarember, and Owen[20] enumerate eight techniques for keeping abstracts to a minimum length: (1) the use of selected standard abbreviations; (2) the use of a generic expression to replace a series of specific terms, within limits; (3) limiting the abstract strictly to new information; (4) omitting author's future plans; (5) omitting statements describing how the document is an improvement over previous work; (6) avoiding involved phraseology; (7) outlining subject

matter covered and organizing the author's main points when the document has no central theme or conclusion to draw; (8) not repeating the title if it is a title-first abstract.

Abstracts may be slanted or written in a manner best suited to the needs of a particular audience. A slanted abstract often selects that novel information contained within the document which is most important to the specific user group even though it may be only incidental to the main subject of the original document. If desired, abstractors should be directed to scan the document for such information and not to rely solely on title or even on the author's abstract to determine what information should be included in the abstract. One example of rules for slanting abstracts is the *Directions for Abstractors and Section Editors of Chemical Abstracts*[21].

2.4 Standards of Abstracts

There is no single international standard for abstracts. In 1961, the International Organization for Standards (ISO) published a recommendation concerning abstracts and synopses[22]. The distinction made between a synopsis and an abstract no longer strictly holds. In the ISO guide there are no recommendations for style. The UNESCO Guide mentioned above[19] does include general directives on the style of abstracts and recommends a limit of 200–250 words. It also recommends that the abstract be written in one of the widely used languages regardless of the language of the document.

The United States Defense Documentation Center developed a set of abstracting guidelines which were published in 1968 (Ref.23). Included in the guidelines are instructions for preparing abstracts, symbols to be used, and sample abstracts. These Guidelines recommend the use of an informative abstract, if possible, a limit of 200–250 words, and define additional rules for preparing abstracts. The Defense Documentation Center guidelines apply only to abstracts of technical reports produced by the Department of Defense but they are very useful to abstractors of all report literature. Many of the rules could also serve for abstracting journal articles and other types of documents.

The most comprehensive official standard is the American National Standards Institute Committee Z39 Standard approved in 1970 (Ref.24). This standard is currently undergoing minor editorial revision, which is not expected to change it in any substantive way. Its abstract summarizes the recommendations as follows:

> Prepare an abstract for every formal item in journals and proceedings, and for each separately published report, pamphlet, thesis, monograph, and patent. Place the abstract as early as possible in the document. Make the abstract as informative as the document will permit, so that readers may decide whether they need to read the entire document. State the purpose, methods, results, and conclusions presented in the document, either in that order or with initial emphasis on findings.
>
> Make each abstract self-contained but concise; retain the basic information and tone of the original document. Keep abstracts of most papers to fewer than 250 words (preferably on one page), and abstracts of short communications to fewer than 100 words. Write most abstracts in a single paragraph. Normally employ complete, connected sentences; active verbs; and the third person. Employ standard nomenclature, or define unfamiliar terms, abbreviations, and symbols the first they occur in the abstract.
>
> When authors' abstracts are employed in secondary services, precede or follow each abstract with the complete bibliographic citation of the document described. Include pertinent information about the document itself (type, number of citations, etc.) if this is necessary to complete the message of the abstract[25].

2.5 Editing of Abstracts

Most abstracts are edited for clarity, accuracy, consistency, completeness, and appropriateness. Each abstract is checked for adherence to style rules. Also, topical sentences must be checked for clear emphasis on the major findings. The entire abstract should be edited for clarity, brevity, completeness, readability, and style. Borko and Bernier include an entire chapter on editing in their text which focuses on the elimination of errors and on classifying and indexing abstracts[26]. Editing is an essential part of the abstracting process within limits; excessive editing is costly and should be avoided.

If the information center uses abstracts to prepare an alerting service or other publication, the abstracts may be classified and arranged by subjects. Subject expertise is required for the editor to determine the arrangement of the abstracts and the assignment of categories. Editors may also assign documents to the abstractors according to subject and language expertise. A system for keeping track of these assignments to avoid duplication, overloading of any one individual with work, and missing documents should be established and maintained. The mechanism for control may be a simple card file or an automated system such as the ones used by some of the larger abstracting and indexing services.

2.6 Requirements for Abstractors

2.6.1 Selection of Abstractors

Although most of the techniques for abstracting described above can be taught some editors and managers of A&I services are convinced that in addition to techniques there are certain natural aptitudes required to be a good abstractor. Some describe this as an "ability to write well" others as a "natural talent". Many argue that a solid background in the subject area of the document collection is essential, but others insist that they prefer to hire language experts or others with writing skill and experience and to require subject expertise of indexers.

An administrator must define the tasks to be performed by the abstractor and prepare a job description, specifically delineating the duties of the position. Such requirements as subject expertise, language skills, previous experience, and training in abstracting should be included where applicable. A basic question to be answered is whether subject analysis and abstracting will be done by the same person. Will bibliographic descriptions, perhaps including translation of titles, be prepared by the abstractor or by a cataloguer? Given a set of well-established criteria in a job description, the selection of individuals can then be made against the job description.

2.6.2 Training and Evaluation

A procedure for training, reviewing the abstractor's work (usually on a daily basis at first), and correcting and editing his work must be established. Estimates of the time needed to train an abstractor will range from six to 18 months.

The training procedure should be defined and described, perhaps as part of a procedures manual for the information center. One possible procedure may be outlined briefly as follows:

(1) Introductory lectures on characteristics of users of the information center, specific needs of the user audience, scope of the collection, type of documents included, the center's philosophy of slanting abstracts, and the job description of the abstractor.

(2) Review of sample abstracts and the uses of the abstracts.

(3) Overview of the style manual and rules for abstracting.

(4) Abstractor reads selected sections of the manual and prepares a few abstracts for a preselected group of one type of document, consulting the manual as needed.

(5) Supervisor reviews abstracts with trainee.

(6) Editor edits abstracts and reviews them with trainee.

(7) Trainee rewrites abstracts if necessary, consulting manual.

(8) Procedures are repeated until editor and supervisor are satisfied with the abstracts being prepared.

(9) The procedure is repeated for more difficult documents and for other types of documents.

(10) Trainees' work continues to be evaluated and reviewed regularly.

Abstracts should be evaluated as indicated above under editing, in terms of completeness, accuracy, clarity, consistency, appropriateness for the user audience, adherence to standards, and conformity to the center's style manual. A specific set of evaluation criteria shoul be developed and included in the center's procedure manual. These criteria might include:

- An overall rating of quality.
- Adherence to the Center's (or some other selected) style manual.
- Adherence to an existing standard.
- Completeness.
- Correctness (i.e., lack of errors).
- Consistency of style.
- Clarity.
- Quality of topical sentence
- Adequacy as a source of indexing terms.
- Appropriateness of abstract to users' needs.
- Quality of translation, if relevant.

A time schedule for evaluation of trainees should be defined and should include specific goals. For example, one goal might be that an acceptable abstract for an English language journal article with an author abstract available is expected after six months of training. If an abstractor is given the opportunity to advance to a position in which he proofreads and/or edits abstracts prepared by others, this should be specified. The time at which this becomes possible should be stated clearly when the trainee is hired.

Abstractors should be encouraged to attend professional meetings and to participate in educational seminars to improve their skills. Such participation provides an opportunity to keep abreast of new developments and to get a broader perspective in the field of abstracting. Opportunities should be provided for staff to keep up with the literature in the field, to meet regularly with other abstractors on the staff, and perhaps to undertake research.

In summary, requirements for the selection, training, and evaluation of abstractors have been outlined above. One possible series of steps for training and some basic evaluation criteria have been described. As part of the procedures for the selection, training, and evaluation of abstractors an information center should have specific job description for abstractors, a procedures manual which includes a style manual for abstracting, a set of criteria for evaluating abstractors' work, and a clearly defined schedule for possible promotion.

3. SUBJECT ANALYSIS

3.1 Definition of Indexing or Subject Analysis

The remainder of this Section of the Manual draws upon the extensive work done by the author in connection with the National Federation of Abstracting and Indexing Services' Indexing in Perspective Seminar and the Federation's Indexing in Perspective Education Kit[27] in the 1974–1977 period. Indexing has been defined as "the process of analyzing the information content of recorded knowledge and expressing this information content in the language of the indexing system"[28]. John Rothman has defined an index as " . . . a systematic guide to items contained in or concepts derived from a collection"[29]. He further describes the operations in the process of indexing as:

> . . . (1) scanning the collection, (2) analyzing its content, this content analysis being based on predetermined criteria of use of the collection and the index, (3) tagging discrete items in the collection with appropriate identifiers, and (4) adding to each identifier the precise location within the collection where the item occurs, so that it may be retrieved. Additional functions, which may but need not be performed by the same indexer, are:
>
> (1) cumulating the resulting entries into a cohesive, consistent whole, (2) establishing rules for the selection of identifiers, (3) establishing a pattern of interrelationship of identifiers (through cross references, tracings, and scope notes), (4) establishing the format of the locator, and (5) determining the physical form in which the completed index is to be published or otherwise made available for use. Note that the process of indexing does not include the actual production (for example, printing) of the completed index; and that the term is never applied to using an index[30].

3.2 A Brief Historical Perspective

3.2.1 Traditional Controlled Vocabulary Systems

Traditionally, indexing has involved a deductive method of organizing knowledge. In such indexing systems, knowledge is divided into broad subject categories; each category is subdivided; and the subcategories are subdivided. Thus, the organizational scheme is based on subject disciplines and the scheme is hierarchical. In these indexing systems, a classification number is usually assigned to each category and its subdivisions. The numbering system is designed so that numbers can be added for new subcategories. The Dewey Decimal Classification, the Library of Congress Classification of the United States, and the Universal Decimal Classification schemes are examples of traditional indexing schemes and are usually referred to as classification schemes. These schemes were originally developed to organize collections of books on shelves in libraries and to permit browsing in shelf areas arranged by classification number. A list of the hierarchical subject headings used, usually arranged alphabetically, provides an index to the subject headings.

As a document is added to a collection, the indexer must make a decision about the subject content of the document and select the appropriate vocabulary terms, (e.g., subject headings) and, if applicable, the appropriate numbers from the corresponding classification scheme. The indexer asks himself, "What is this document about?" and selects the subject headings and classification number. This type of indexing is sometimes referred to as assignment indexing. The indexer makes a subjective decision about the subject content of the document and translates this decision into the indexing language used.

The vocabulary in traditional indexing systems is controlled and subject terms are linked together, or bound, to represent a discipline or subcategory of a discipline. For example, Twentieth Century French Literature may be used as a subject heading to represent three hierarchical levels of a subject. In this type of system, it is obvious that considerable time and money are spent at the input stage of a system (as a document is entered into the collection), because indexers with subject knowledge and training in indexing must analyze each document to determine what it is about and then carefully select the appropriate subject terms and classification numbers. The indexer must try to predict how people will later try to retrieve the document. Usually only three or four subject headings are selected to describe the document, and often only one classification number is selected since that number determines where the document will be placed on the shelves.

3.2.2 Faceted Classification Schemes

A different type of classification scheme was developed in 1933 to allow for more flexible coordination of subject approaches to documents. In his Colon Classification Scheme, Ranganathan proposed that documents be analyzed by generic concepts, which he called facets. Rather than organizing knowledge by subject disciplines, the scheme organizes knowledge according to five facets: Personality, Matter, Energy, Space, and Time (PMEST). Each document is described according to these facets and numbers corresponding to each of the facets are assigned. The numbers are then joined together with specific punctuation marks into a chain. The system is too complex to describe adequately here. Interested persons are referred to S.R.Ranganathan's publications, especially his *Colon Classification* (1965) (Ref.31) and *Colon Classification*, seventh edition (1972) (Ref.32). The Colon Classification is generally not used for specialized technical collections because of the extensive training required to use it and the time required to index each document.

3.2.3 Natural Language Systems

After World War II there was a definite shift from the exclusive use of traditional indexing systems using controlled vocabulary to systems using uncontrolled vocabulary in the form of natural language. This shift was precipitated by the large increase in the number of technical reports issued during the war and by the need to quickly identify these reports and journal articles, rather than books, which contained current material on science and technology. A principal figure in the movement toward natural language systems was Mortimer Taube, who developed the idea of UNITERMS in the United States.

Taube recognized the fact that only a portion of the documents added to a collection are ever used; for example, not all articles in an issue of a journal are read by the users of a specific collection and some books are never read. He argued that time and effort should be put, not into providing costly subject analysis of all documents at the input stage when they are added to a collection, but rather should be put into effectively retrieving all relevant documents from a collection at the output stage in response to an actual, specific request. He suggested that the words the author used in the original document be the index terms and that these terms be completely uncontrolled and unaltered. Each significant word selected as a subject term, called a "uniterm", should be allowed to stand alone and should be joined with other terms (or coordinated) when the user attempted to retrieve the relevant documents from the collection.

Taube's idea represented a change to the user of the natural language in which the documents are written. The choice of subject terms became the province of the author rather than the indexer and thus became more objective. The indexer no longer asked what the document was about but was required instead to extract from the document, itself, those terms the author chose as subject terms. This type of indexing is often referred to as indexing by extraction, in contrast to indexing by assignment.

This new type of indexing put the responsibility for combining or coordinating terms on the user of the collection (or on the intermediary information specialist) at the output end of the information transfer process. The advent of computers aided considerably since coordinating terms together at the output end takes advantage of the computer's ability to manipulate words and numbers easily and quickly.

The distinction between pre-coordinate and post-coordinate indexing systems emerged. Traditional indexing systems pre-coordinated the terms by joining them into subject headings. The natural language systems kept each term separate (e.g., literature might be one term and French a separate term) and required coordinating terms at the point of retrieval rather than input to a collection.

Although Taube's original idea of uniterms seemed very good in theory, it generated some problems in actual practice. For example, there are many synonyms for words and variations on spellings of the same word, requiring the searcher to think of every possible synonym and spelling authors might have used. Also, some words have a very different meaning when they appear together from the meanings they may have separately. For example, New York is very different from the separate words new and York. To overcome some of the problems inherent in the use of natural language, several techniques were developed to be used with the uniterms, including the use of roles to identify how the term is used (e.g., as in the effect of A on B *or* the effect of B on A) and links to pre-coordinate certain terms.

Taube modified his theory and decided to substitute "concepts" for uniterms. The choice of the word "concept" resulted in some confusion because concept usually connotes idea, implying that indexing by assignment rather than indexing by extraction was being done. Indexers were not actually examining, "What is this document about?", but were selecting the significant terms from the document to apply to the document.

Important work on thesaurus development was undertaken in the late 1950's and early 1960's. The thesaurus was developed as a method for controlling natural language to eliminate problems with synonyms, near synonyms, and to indicate relationships among terms used. Paragraph 4 discusses thesaurus development in detail.

3.2.4 Effects of Computers on Indexes

The advent of the computer had significant impact on the development of indexes, particularly as related to the abstracting and indexing (A&I) services. The use of computers in abstracting and indexing are discussed in Paragraph 5. Also, examples of how computers are used for preparing certain types of indexes will be described briefly in Paragraph 3.4.3. It is worth noting that computers have not yet replaced intellectual effort in indexing, rather they have been found to be most effective in manipulating words and numbers to coordinate terms and to reformat information in many different ways.

3.3 Types of Indexes

In this section several examples of types of indexes will be described briefly. For more detailed information and additional examples, the reader is referred to the *UNISIST/NFAIS Indexing in Perspective Education Kit*[27].

3.3.1 Traditional Controlled Vocabulary Systems

The traditional controlled vocabulary indexing systems are probably those indexing systems which are most familiar to information specialists and library users. They are pre-coordinate indexing systems using subject headings consisting of words joined together. These systems require analysis of each document as it is added to the collection and rely upon the indexer to determine what the document is about and to select the appropriate subject headings from an authority list of headings. Examples of this type of indexing system are subject headings used for classifying books, back-of-the-book indexes, and journal article indexes which use hierarchical subject headings. Each of these three examples will be discussed briefly.

Subject Headings

As was discussed above, many libraries use a discipline-based list of subject headings to classify their book collections. Classification schemes, such as the Universal Dewey Classification and US Library of Congress classification scheme, divide knowledge into categories and subcategories by subject discipline in a hierarchical structure. A number is assigned to each category and subcategory. Usually, the number is put onto the book and book is shelved according to that number. One card is filed in a catalog under the main entry (see Section 2) and cards are also filed under each assigned subject heading. If the stacks of the library are open, readers may browse through the shelves to locate books on a subject. The classification system allows for books on related topics to be shelved in the same physical area. If the stacks are closed, the reader must browse through the catalog, which serves as the major subject access point to the collection.

This type of system generally works fairly well for book collections if great depth of indexing (e.g., to the level of chapters within books) is not needed or if the subject area is not changing rapidly. Because only authorized subject headings may be used, any potential new headings must be examined carefully to determine whether they should be added and where they fit into the hierarchical system.

Back-of-the-Book Indexes

A back-of-the-book index involves the same principles as the subject heading system used for books. An indexer of a book usually defines the subject area covered by the book, divides it into categories and subcategories and arranges the index entries in alphabetical order with subdivisions, which are narrower levels in a hierarchy. There are usually only three hierarchical levels. References to preferred terms are included as cross-references. A sample entry in a back-of-the-book index might look like this:

Indexing, 3, 23, 86, 174-183, 203-221, 345-357, 400-461
- automatic (*See* Automatic Indexing)
- book (*See* Book Indexing)
- chain (*See* Chain Indexing)
- citation (*See* Citation Indexing)
- compatibility, 23
- computer-assisted 86, 183, 203-205
- consistency, 187
- coordinate (*See* Coordinate Indexing)
- cost, 196, 320
  - computer costs, 196
  - salary survey of indexers, 345-362
- etc.

Under the letter "A" one would find the preferred term Automatic Indexing with its entries, under B one would find entries on Book Indexing, etc.

Such indexes are not extensive, usually covering only a few pages, and are easily scanned for other possible entries, if the user does not find the entry he expects to find. Also, the "collection" being indexed is complete so the indexer need not be concerned with new terms that may be added or with future vocabulary changes, which are problems encountered with other types of indexes. The back-of-the-book indexer is probably one of the easier applications of the use of traditional subject headings.

Subject Heading Hierarchical Journal Article Indexes

Indexing systems using hierarchical subject headings are also used to index articles within journals by journal publishers in their annual indexes and by A&I services. In the United States, the H.W.Wilson company uses traditional controlled-vocabulary subject headings to index the journal articles it covers in its indexing services. For example, in *Library Literature* the broad subject READING may be divided into Abilities, Educational aspects, Pyschological aspects, and Special Groups of readers. The subcategory, Special groups of readers, may be further subdivided into: Adult beginners, Adults, Blind, College Students, etc. References to journal articles in each category, subcategory, or sub-subcategory are listed under each subject heading. Because the monthly indexes are cumulated into an annual index, a sub-subcategory may have too many entries to be scanned easily. In that case a new category may be established.

Similar systems are also used for clipping files and for vertical files. Many small information centers maintain vertical files of brochures, pamphlets, unpublished articles, catalogs, etc. and use the same, or similar, subject headings as those used for the book collection. A specialized information center may wish to consider using a similar system for its technical reports and journal articles, so that one indexing system could be used for the entire collection.

3.4 Natural Language Systems

Several types of indexing systems have been developed to use the natural language of documents. Many of these were designed specifically for technical report collections and for indexing journal articles. These include concept coordination, optical coincidence, and rotated and permuted indexing systems.

3.4.1 Concept Coordination Systems

One type of *manual* indexing system which is frequently used for specialized collections is a concept coordination system. Many information centers have replaced these manual systems with computerized systems which follow the same basic principles; however, for those information centers which do not wish to adopt a computerized system, or are unable to do so, this type of manual system may be appropriate and useful.

Starting with a basic collection of documents (often technical reports and journal articles, although books, patents, theses, etc. may be included) an indexer reads through the documents or their abstracts and extracts those terms to be used as index terms. These terms may then be checked in the thesaurus used to identify which synonym or preferred term to use. (For a more detailed description of techniques of indexing see paragraph 3.6.2.) Each document is given an accession number, which does not relate to subject classification, but merely locates the document on a shelf. A card is made for each index term and the number of the document is added to the card for every term selected for that document.

For example, to index an article entitled, "The Use of Subject Indexes for Information Retrieval in Brazil" (Document #123) using the United States National Aeronautics and Space Administration (NASA) Thesaurus[33] the indexer would extract all the relevant terms describing the document – perhaps 40 or 50 terms – and would look up each term in the thesaurus. The term "information" may be used, as may the related terms, "communicating", and "communication". The bound term, "Information retrieval" and the term "retrieval" may be used. The correct form for indexes is Indexes (Documentation). Many other related terms may be selected, with the preferred term being used in each case. Other terms related to the geographical area and the type of library might be extracted from the document and checked against the thesaurus. On the card for *each* term selected, the document number 123 would be added.

To search the collection for all documents on Indexes and Information Retrieval and South America, the card for each of the three index terms would be pulled and the list of document numbers on each card compared to the other lists. All documents listed on all three cards would be selected as potentially relevant. The coordination of the subject terms is done at the output or retrieval end. The vocabulary in this system should be kept as free as possible so that maximum manipulating of the collection is possible.

One technique used to simplify comparing the cards to see which documents are listed on all cards is called a Terminal Digit system. Instead of listing each document on the appropriate card as it is added to the collection in numerical order (e.g., 1, 8, 97, 123), the document numbers are listed in columns according to their last digit. Thus, two cards being coordinated might look like this:

Indexes (Documentation)

60	1	123	14	25	97	49
		293		65	137	

South America

50	1	123		35		
		683		65		99

The searcher can easily see that documents numbered 1, 123, and 65 appear on both cards and that these two documents should be retrieved and examined. Of course, this is a simplified example. It should be evident that as the collection grows and as a searcher is comparing nine or ten subject terms, this use of the terminal digit system could save considerable time.

3.4.2 Optical Coincidence Formats and Edgenotched Cards

Indexing formats using the same principles as the concept coordination system are the optical coincidence formats. Special cards are available which have spaces marked with numbers which may be physically punched out with a pencil or other implement to produce a hole that will allow light to shine through. Portapunch cards and Peekaboo cards are two examples of this type of card.

Although it is not technically an *optical* coincidence format, the edge-notched card is similar. Edge-notched cards have traditionally been used for library circulation systems and by researchers to provide a simple subject index to their bibliographies. The optical coincidence cards and the edge-notched cards are devices which simplify matching document numbers. The document number is punched out on the appropriate card for each subject term. The searcher then co-ordinates the subject cards and compares them by shining a light through the cards or inserting a long needle through the cards to determine which cards have the same hole punched. The documents corresponding to those numbers are then retrieved. It should be clear that these systems could quickly become awkward to use for large collections, as they are physically difficult to handle beyond a certain number of cards. Although these are manual systems it is easy to see how a computer could perform the same tasks more quickly and certainly with less effort. However, given the budgetary limits placed on many libraries or the small size of many collections, such manual systems may be appropriate and efficient for many small specialized information centers.

3.4.3 Rotated and Permuted Indexes

In the late 1950's computers were used to produce indexes. Hans Peter Luhn and Phyllis Baxendale at International Business Machines (IBM) used the natural language in titles of documents with a computer to generate the first Key Word in Context (KWIC) index. The KWIC index was developed as a quick interim index to use before the more complete subject indexing became available to the literature in the A&I services. At that time the A&I services were prepared manually and type set manually so there was a considerable time lag between the publication of the original primary journal article and its abstracting and subject indexing by the A&I services.

A KWIC index is produced by rotating all the significant words in a title by computer so that each significant word appears alphabetically in the index, followed by the other words in the title and the document number. KWIC indexes made no attempt to eliminate synonyms, variations in spelling, or misleading titles. No intellectural effort, and hence very little cost, was involved. Clerical assistants were trained to type the titles exactly as they appeared and to add the document number.

Very similar to a KWIC Index is the KWOC (Key Word Out of Context) Index. It differs from a KWIC index in that the word being displayed alphabetically is separated from the rest of the title by several spaces or even by a line. Simple packaged computer programs are available to produce rotating indexes.

Rotated indexes are sometimes incorrectly referred to as permuted indexes. In its pure sense, in a permuted index each word is linked up with every other significant word in the title. The *Permuterm Subject Index* published by the Institute for Scientific Information is a classic permuted index in that each significant word in a title is linked with the "co-term" which is every other significant word in the title.

In both rotated and permuted indexes, a list of words which are considered to be insignificant (e.g., it, and, but, to) are not included in the index. The list of these words is called a "stop list", and the computer is instructed not to include them in the alphabetical list. Care must be taken when developing the stop list not to include a word on the list which might be significant in specialized cases. For example, the word, "a", may seem to be unimportant but searching for Vitamin A or A vitamins might be very difficult if provisions are not made in special programming instructions to the computer for locating the A when it relates to vitamins.

3.5 Criteria for the Selection of an Indexing System

Given the wide range of indexing systems available, a logical question is which system should an information center select for its use. There is no single answer which says that system X is best. However, by reviewing the following criteria and others which may be developed by the individual center, one can determine which system is best for the individual center's needs. The set of criteria outlined below is not intended to be all-inclusive and comprehensive, but rather to be a starting point from which an individual center can develop its own complete set of criteria.

3.5.1 Users of System

Perhaps the single most important criterion in selecting an indexing system is the group of users of the system. Basic characteristics, such as educational level, language competence, subject interests, and types of documents used, are all important. Anyone with experience in special library work should be familiar with user studies and with the procedures for determining user needs and should be able to develop a profile of the users of the information center.

3.5.2 Cost Considerations

Probably the second most important criterion is that of cost. Ideal indexing systems are relatively simple to design, but few centers can afford to implement them. Careful costing of the systems being considered should be worked out and a realistic budget must be developed. One approach is to outline an "ideal" system for the organization and then to identify those elements which could be developed within budgetary constraints. Also, certain desired characteristics which at first seemed too expensive might be possible through the use of existing facilities elsewhere within the organization. For example, computer programming staff and expertise might be available within the organization's accounting

department. Projected costs for several years in advance should be determined, and costs for maintaining the system and adding new documents should be included.

3.5.3 Staff and Materiel

Another criterion for the selection of an indexing system is that of available staff and materiel. Most organizations cannot afford to hire entirely new staff to develop and implement an indexing system and must rely on existing staff, with one or two additions. Retraining through educational seminars or courses at universities may be needed to teach staff how to index and abstract documents. An outside consultant may be brought in to set up the system and to train staff. A manager should review with his staff their qualifications and expertise to determine what strengths can be drawn upon from within the staff and where the potential weak points will be. For example, if the staff is well-trained in a particular system of indexing that system might be worth investigating as a potential one for the collection rather than one which is totally unknown.

Available materiel might range from a supply of edge-notched cards to extensive computer facilities. However, the mere availability of materiel does not mean that that is the best system for the collection and for the center. The best system should be identified and then existing materiel used if relevant.

3.5.4 Hospitality

The trait of hospitality refers to the ability of the system to accommodate new documents and new subject terms. Any system must allow room for expansion if documents are to be added to the collection. A rigid list of subject headings which allow no room for new subject areas is virtually useless. New subject terms come into existence regularly and must be accommodated by the system. The various systems being considered should be examined in light of their hospitality in allowing documents to be added to the collection and in accommodating new subject terms.

3.5.5 Types of Documents

Another criterion is that of the type of documents to be included in the collection. Several systems are already in use for technical report collections or for monographs. If the information center's collection will be primarily in one of these areas it would be reasonable to consider adopting one of the existing systems. If the collection will include a large number of patents or theses a different system might be needed. The language of the documents should also be taken into account. If several different languages will be included special care must be taken with the use of natural language terms to include the equivalent terms in other languages.

For some types of documents particular characteristics are more important than for other types of documents. For example, the university at which a dissertation is written is important for dissertations but may not be as important for monographs. Technical reports have several identifying numbers (e.g., contract numbers, report numbers, and accession numbers) unique to the report literature. A subject approach geographically is important for maps more so than for most journal articles. There are similar considerations necessary for other types.

A determination of the types of documents to be included in the collection is important in order to select an indexing system and to identify which subject approaches are most relevant.

3.5.6 Depth of Indexing Required

The depth of indexing required varies according to types of documents and to potential uses of the documents. For monographs, two or three broad subject headings may be all that is needed to identify which monographs are needed on a particular subject. However, if the entire collection is devoted to one subject, deeper indexing may be needed even for monographs. A subject heading on Aeronautical Engineering may be acceptable for an engineering collection, but useless if the entire collection is on aeronautical engineering. Journal articles and technical reports are usually indexed to a greater depth of subject than are monographs and conference proceedings, because books usually deal with a broader subject level than do reports and articles. However, in a special collection it may be advisable to index monographs to the chapter level rather than to the collective level of the total book.

If monographs are likely to be used as background reading or as a refresher in an unfamiliar area, the depth of indexing need not be as great as it should be if specific data within chapters is needed. Many information centers acquire a small number of publications on peripheral fields of interest for users to scan for general information. Similarly, a book on a peripheral subject area yet containing a chapter of direct interest to the users of the collection may be indexed to the depth of the chapter so that valuable information is not lost.

3.5.7 Expansion of Collection

The expected growth of the collection is an important criterion in selecting an indexing system. If the collection is a historical one and is not expected to grow much, not as much hospitality in the indexing terminology will be needed since not many new terms would be expected. In contrast, a collection of journal articles and technical reports on a

growing field should be expected to grow rapidly. Higher costs for adding to the collection and for maintaining the system should be expected in such cases.

3.6 Effective Indexing Techniques

Unfortunately, there are no easy steps or instructions for how to index effectively. Indexing is a complicated process requiring extensive training under an experienced supervisor and is specific to the indexing system used. F.R.Whaley attempted to summarize what the indexer-abstractor does in a journal article written in 1965 (Ref.34) but his article merely provides an introductory overview of the process. Some useful, if rather general guidelines have been prepared for UNISIST[35]. Because they were designed to be independent of any particular indexing system, the guidelines are necessarily fairly general. However, they are among the more useful of the available guidelines or criteria, and should be consulted.

There is no single international standard on indexing; however, a US standard does exist. The American National Standards Institute Committee Z39 issued a standard (ANSI Z39.4-1968) on Basic Criteria for Indexes in 1968 (Ref.36). The Standard includes several useful definitions and some, rather general, criteria for indexes. This standard is currently under revision, and a new, revised version is expected in 1978. In terms of useful techniques for indexing, in this author's opinion, this standard is probably the single best brief document currently available.

3.6.1 Selectivity

John Rothman stated very succinctly that,

> Good indexing is a matter of making the right choices. Except for concordances, in which every occurrence of a word, regardless of language or context, must be recorded, indexes require an exercise of selection at virtually every stage. Selection necessarily means not only inclusion but also exclusion, and the quality of an index sometimes depends on what is not indexed, or what index terms are not used.

If the indexer also does abstracting, he may be the individual who decides whether an item is to be indexed at all. In some information centers, an editor will have assigned the document to the indexer, but in other centers the indexer, himself, determines whether the document should be indexed. If the document is to be indexed, the indexer then determines what depth of indexing is required and which subject terms should be used. Keeping in mind the users of the collection, the indexer either assigns or extracts the appropriate terms and negotiates each term against the thesaurus to determine whether that term or a preferred term should be used and which broader, narrower, and related terms should be added. Using the procedures manual, the indexer follows the established procedures for the system, heeding any limits (e.g., maximum number of terms) in order to index each document. Throughout the entire process, the judgment of the indexer must be used to select terms, depth of indexing, additional descriptors such as geographic or company names, and other terms. It should be apparent that the indexer's selectivity judgment is very important for good and effective indexing.

3.6.2 Techniques for Indexing

Unfortunately, there is no handy checklist of techniques for indexing similar to those in paragraph 2.3.3 for writing abstracts, because indexing techniques vary considerably according to type of indexing (by assignment or by extraction), to the type of system used, and, frequently, to the subject of the document, and even to the type of document. A few general steps can be identified, which are common to most indexing systems:

(1) Examine the document (or abstract) to determine whether the document should be indexed and to what depth.

(2) If indexing by extraction, extract all relevant terms and look up each term in the thesaurus to identify preferred terms. Check related terms and broader or narrower terms, if appropriate. Include all the appropriate terms in their preferred form.

(3) If indexing by assignment, determine what the document is about and select the appropriate subject headings from the authority list, checking *see* and *see also* references for related subject headings and the correct form of entry.

(4) Always index to the most specific level.

(5) If the system has other types of indexing (e.g., geographic descriptors) assign other indexing terms according to the procedures manual.

(6) Follow any other indexing procedures. For example, some indexing by extraction systems require their indexers to re-examine each document after all terms have been extracted and correct terms chosen, and to think in general terms of what the document is about, then to assign one or two terms which best describe the document, overall.

(7) Check all indexing for accuracy, completeness, and relevance to the user community and to the collection.

Of course, the procedures manual for the information center is the most important authority for how the indexing should be done. Indexing is a procedure which is best learned through on-the-job training within a specific system under the supervision of an experienced indexer.

3.6.3 Evaluation of Indexing

The ideal test of an indexing system is to determine how well one can get out all documents from a collection on the topic without retrieving any documents not on the topic. There are several different ways to evaluate indexing as part of the total services of a library or information center. The literature on evaluation is extensive; among the best studies is that by F.W.Lancaster, *The Measurement and Evaluation of Library Services*[38], which includes extensive bibliographies. It is essential that any system be evaluated regularly and that necessary changes be made based on the results of the evaluation.

Among the criteria for evaluation are the measures of recall and precision, which should be familiar to all information center managers. For a review of these measures the reader is directed to Lancaster's *Information Retrieval Systems, Characteristics, Testing and Evaluation*[39]. A review article on relevance written by T.Saracevic appeared in the *Journal of the American Society for Information Science* under the title, "Relevance; a Review of and a Framework for the Thinking on the Notion in Information Science"[40].

4. THESAURUS DEVELOPMENT

With the advent of the use of natural language for indexing, it quickly became apparent that some control over the natural language was necessary to eliminate synonyms and near-synonyms and to show relationships among terms. The primary method used to control vocabulary in the late 1950's and early 1960's was the thesaurus.

4.1 Definition of Thesaurus

A thesaurus is a post-coordinate listing of terms showing relationships among terms, specifically the generic relationship of broader and narrower terms and other relationships of synonyms and related terms. The precise definition of broader and narrower terms is a necessary trait of a true thesaurus. This generic relationship is a fact and can *never* be altered by term or document context. A generic relationship must *always* be true for it to be established as a broader-narrower relationship in a thesaurus.

4.2 Comparison to List of Subject Headings

Although a list of subject headings may look like a thesaurus (and sometimes is even called a thesaurus) it differs from a true thesaurus in that its pre-coordinate subject headings are derived deductively by dividing a subject area into subdivisions and further sub-subdivisions. Each subdivision is not always a narrower section of the subject. For example, in a list of subject headings on environmental studies one may find:

Noise
- Bibliography
- Biography
- Pollution
  - Laws and Legislation

Obviously, Pollution is not *always* a subject division of Noise; there is air pollution, water pollution, etc. Similarly, laws and legislation are not *always* subject divisions of pollution. In a true thesaurus, such relationships are not permitted.

4.3 Development of the Thesaurus

An overview, tracing the development of the thesaurus and showing examples of early thesauri appears in the *UNISIST/NFAIS Indexing Kit*[27]. Many thesauri to control natural language were built and developed in the late 1950's and early 1960's. One of the earliest thesauri was built in the United States by the Engineers Joint Council. This was a classic example of an inductive method of building a natural language system. Experts in the various engineering specialties were asked to contribute actual words to be included in the thesaurus. Different specialties, such as mechanical engineering or aeronautical engineering, contributed words for the thesaurus through a series of meetings of individuals from each specialty. Many of the words contributed were synonyms or near-synonyms for the same basic concept, yet the representatives from the various specialties insisted that the specific term was the only appropriate one to use for their particular area of engineering. Thus, a problem arose concerning whether many synonyms should be accepted as legitimate terms for the thesaurus or whether only one preferred term should be used and the other terms entered as cross references to the preferred term. Decisions were made to include many of these synonyms and near synonyms, and the *EJC Thesaurus*[41] became more of a framework to be used to build minithesauri on specific topics, than a thesaurus, itself. This thesaurus is not used by any large indexing service in engineering, primarily for these reasons.

A second important thesaurus was the US Armed Services Technical Information Agency (ASTIA) Thesaurus[42]. The terms, called "descriptors", used in this thesaurus were more defined and precoordinated than the pure natural language of the documents. The alphabetical descriptors were also associated with classification groupings to further define their place in the vocabulary system. The *ASTIA Thesaurus* was revised and became the *NASA Thesaurus*[33]. Definitions were not included in the *NASA Thesaurus*; however class numbers to class groupings are still included.

The American Petroleum Institute developed a thesaurus in a slightly different manner, using faceted headings rather than subject discipline-based headings. The faceted classification is the tool for updating the vocabulary. Term relationships are clearly identified. The *API Thesaurus*[43] was conceived as a vocabulary control for post- not pre-coordinate systems. The terms in the thesaurus are derived from the natural language of the subject area, and these terms were originally compiled from a collection of documents on the subject. The terms are those individual words selected from the natural language of the documents and are not based on preconceived subject headings or ideas. Thus, the API Thesaurus is a true thesaurus.

Of course, it is much easier and less expensive to use an existing thesaurus than to develop. Not only is there a very large initial cost to build a thesaurus (the average thesaurus contains 5,000 to 6,000 terms), but the time and cost of maintaining a thesaurus are also extensive. If at all possible, an information center should use, or adapt for its use, an existing thesaurus, rather than building one. If a center must build, or adapt, its own thesaurus, it must be prepared to expend a large amount of time and money to do so. Also, an expert on thesaurus development should be hired to oversee the project.

4.4 Standards for Thesauri

A useful and comprehensive set of guidelines for thesauri exists as the American National Standards Institute Standard (Z39.19-1974), *Guidelines for Thesaurus Structure, Construction and Use*[44]. This standard presents rules and conventions for the structure, construction, and maintenance of a thesaurus of terms. It is also an aid in using an existing thesaurus.

4.5 Maintenance

In order for a thesaurus to be useful and effective it must be adequately maintained. Any thesaurus changes over time as the language changes. In many cases, there is a tendency for terms in a thesaurus to become too pre-coordinated, and often the thesaurus becomes very similar to a list of subject headings. Terms which appear together *frequently*, rather than *always*, get into the thesaurus. Also terms which are *usually* but not *always* related hierarchically to others find their way into a thesaurus unless care is taken to keep them out. For example, cats are *often* pets, but not *always* pets, as they may be wild cats or laboratory animals, so that cat and pets is *not* a legitimate narrower-broader term relationship; however it is the type of relationship which often finds it way into a thesaurus. Such entries should be kept out of a thesaurus.

Of course, new terms must be added after they have stood the test of time to determine that the term is not merely a passing fad. If a thesaurus is not properly and adequately maintained, its strength as a tool to control vocabulary and to manipulate natural language in a post-coordinate system is greatly diminished. Also, if the thesaurus is not tightly controlled and maintained and the terms kept as unbound as possible, a serious question can be raised concerning whether the costs actually justify the use of the thesaurus over natural text.

4.6 Role of the Lexicographer

If a center does decide to build its own thesaurus, a lexicographer should be employed to oversee the development of the thesaurus, to edit it, to prepare the scope notes, to make decisions concerning preferred terms and relationships among terms, and to oversee the maintenance of the thesaurus. Unless one person is responsible for preparing scope notes, explaining why and how certain terms are used (and for what time-period), and for making decision on which of many synonyms or near-synonyms is the preferred term, inconsistencies will appear in the thesaurus, thus severely reducing its effectiveness. Also, a lexicographer as an individual trained in thesaurus development, provides special expertise on thesaurus development and maintenance and becomes the single, final authority on the thesaurus. The indexers in an information center may well be individuals with their primary expertise in the subject discipline and some training in indexing. A lexicographer is specially trained for working with thesauri. Also, the more people making decisions concerning preferred terms, scope notes, etc., the more chances there will be for inconsistencies to appear and more synonyms to enter the thesaurus, thus limiting the control of the true natural language.

5. USE OF COMPUTERS IN ABSTRACTING AND INDEXING

Computers have been used since the 1950's to produce indexes of all types as was described briefly in paragraph 3.4. Much less work has been done in using computers to abstract. As mentioned above, a review of automatic abstracting by computer appears in Borko and Bernier's book on abstracting[45].

5.1 Use in Abstracting

The results of the many studies referred to by Borko and Bernier indicate that computers are being used to prepare extracts, rather than true abstracts. The resulting abstracts range in quality from fairly good to disappointing, primarily due to problems related to the complexity of the language, itself, and to the need for human intervention to interpret and edit the abstracts. Research is still underway to prepare acceptable abstracts using computers.

5.2 Machine-produced Indexes

Several types of indexes have been produced by computers, as described in paragraph 3.4. KWIC and KWOC are two obvious types of index prepared by computer. The significant words in each title are input into the computer and rotated so that each significant word appears alphabetically in the index. No intellectual effort, and hence little cost, is expended to index the document. However, in a totally computer-produced index there will be many synonyms, near-synonyms, and spelling variations for the same word (e.g., colour and color). These indexes are useful as quickly-produced and cheap-to-produce interim indexes to use before a more detailed and better edited index becomes available.

5.3 Effects of On-line Searching on Indexing

With the ability to make the complete abstract, title, and indexing terms available for computer searching, indexing has entered a new era. The computer can provide an "index" to every word, author's name, word in a journal title, etc. which is input into the computer. Questions are being raised concerning whether expensive indexing is really necessary with this new ability to search all the natural language available on computer tapes. Problems of synonyms, variations in spelling of the same word, and multiple-language data bases are taking on new dimensions. Research is currently underway by many abstracting and indexing services and by other researchers to determine what the effect will be on the indexing of a data base. It is too early to provide any conclusive answers, but this is an area to be watched over the next few years. New theories on indexing and perhaps new techniques for indexing will become available. Managers of information centers should make a special attempt to keep up with the current literature on abstracting and indexing to watch these new developments closely.

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The focus is on a practical, rather than theoretical, approach for both the senior person setting up a new system, as well as junior staff who may be using the manual as a training aid.

The three sections in this volume mainly cover the experience of documentation organisations in the USA and provide an overview of the processes and techniques involved. Examples and guidelines for implementation are given and staffing requirements are discussed.

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